

Electrical Contracting

THE MAGAZINE OF ELECTRICAL CONSTRUCTION



INDUSTRIAL ELECTRIFICATION
SECTION
PAGES 57-72

Big city lights wink out as blackouts and alerts are called along both coasts. America shifts from "Defense" to total war. See "Our Job in '42", page 19 and "On the Alert", page 22.

JANUARY, 1942

HERE ARE THE FACTS

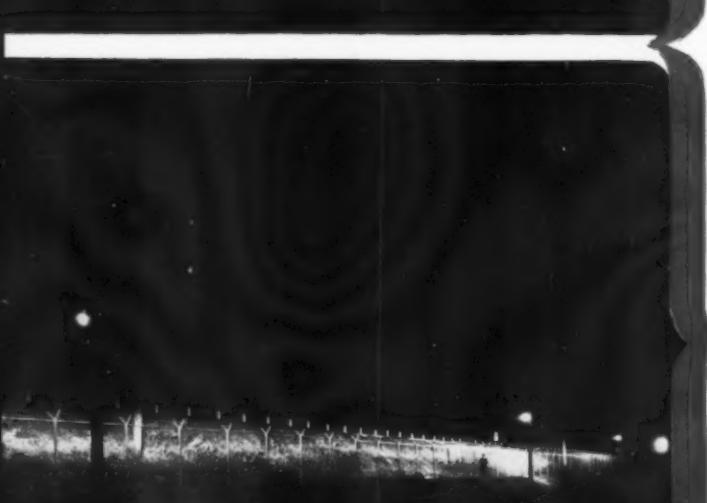
To Help You Do a Better Job
of Fence or Boundary Lighting



FORM 79VR luminaires put high-intensity lighting on every foot of boundary. Intruders can see that detection is inevitable.



FORM 79R luminaires on same poles as in A. Visibility along property line is almost as good, but there is some glare in guard's eyes. Uniformity of illumination between units is sacrificed to obtain a wider band.



FORM 104 luminaires on same poles as in A and B. They utilize glare in eyes of intruder to prevent seeing into the property. Their use is limited to special applications.

THESE PICTURES emphasize why one type of fence or boundary lighting is by all odds better than another in discouraging attempts at entry.

In an Eastern ordnance plant, the management and representatives of the Quartermaster Corps wanted facts and figures to determine the most effective lighting for boundaries. So, General Electric engineers arranged a demonstration. Poles were placed 150 feet apart and 12 feet back of the fence line. Three types of units—Form 79VR, Form 79R, and Form 104 (Fresnel lens)—were installed at each location. Visibility from patrol area, glare in guard's eyes, blinding effect to intruder, illumination with one lamp out, and over-all appearance were each considered in turn.

The result? Form 79VR's definitely proved themselves the most effective lighting units for boundaries. One of the big reasons these luminaires provide better boundary lighting is that an exclusive prism arrangement in the refractor lifts and turns the light rays into two diametric, high-candlepower beams.

A protective lighting installation that was suitable under normal conditions may be entirely inadequate to protect the same property today. Let a G-E lighting specialist help you with your lighting problems. You'll save time by avoiding the long process of experimenting with different light sources; you'll save money because you'll have the right unit from the start. *General Electric Company, Schenectady, N. Y.*

GENERAL ELECTRIC

451-51-3200

SIMPLICITY STRIKES the KEYNOTE!

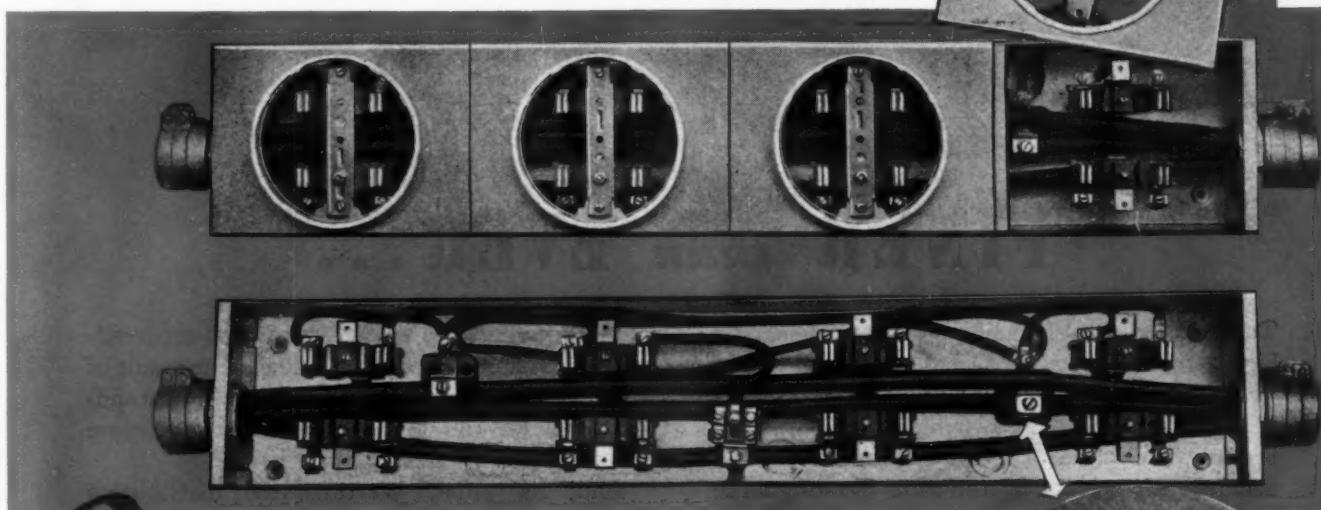
EVERY now and then something gets you, because its utter simplicity proves how good it is!

Men who use lots of them tell us this about Murray Socket Type Meter Troughs. While we make them with various disconnects, the Murray Disconnect is a corker—and you'll agree the moment you see it. Just a simple turn of a screw connects or disconnects completely, safely, without arcing—and there's no danger of touching any "hot" spots with the screwdriver.

Lots of things you should know about these popular devices. Why not send for the free—and instructive—booklet?

**Metropolitan Device Corporation,
Brooklyn, N. Y.**

Made in units of one, two or three—all easily connectible to each other, into gangs of any desired number. It's all quick, easy and workmanlike. You'll be proud of every job you do with Murray Meter Troughs.



Murray METER TROUGHS



Here's one of several types of Murray Solderless Connectors.

ELECTRICAL CONTRACTING, Published monthly, price 25 cents a copy, Vol. 41, No. 1. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 330 West 42nd Street, New York, N. Y. Subscription Rates—U. S. A., and Latin-American Republics, \$2.00 a year, \$3.00 for two years, \$4.00 for three years. Canada \$2.50 a year, \$4.00 for two years, \$5.00 for three years. Great Britain and British Possessions 18 shillings for one year, 36 shillings for three years. All other countries \$3.00 a year; \$6.00 for three years. Entered as second-class matter August 29, 1936, at Post Office at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. Copyright 1942, by McGraw-Hill Publishing Company. Cable address: "McGrawhill, New York." Member A. B. F. Member A. B. C.



FINER *than* EVER...

The requirements of an all-out war now demand a high percentage of all Westinghouse Small Motor production.

Airplanes . . . tanks . . . fighting ships . . . gunfire control equipment . . . all employ motors and generators produced by the same Westinghouse Small Motor Division that normally devotes itself to the manufacture of motors for refrigerators, washing machines, oil burners, stokers, pumps . . . and for the electrical contracting field.

Consequently, Westinghouse Small Motors for the electrical contractors' field will be fewer in

number in 1942. However, those that are available will be finer than ever. For, as the result of our war work, Westinghouse quality standards, always the industry's highest, are more exacting than ever.

And, as usual, Westinghouse distributors everywhere will be glad to consult with you relative to your motor problems. Also to furnish you such motors as the growing war program permits us to make available to you. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N.

Westinghouse Small Motors

"See the Westinghouse Exhibit at the International Heating & Ventilating Exposition, Commercial Museum, Philadelphia, Pa., January 26-30."



J-03152



Repair shop reputations hang on these slender threads

When 9 repair job "come-backs" out of 10 can be traced directly or indirectly to failure of the insulation, it is important for every repair and maintenance shop to pay keen attention to the insulation purchased and its application.

You must have a close source of supply for a complete range of tapes, varnishes, micas, sleeves, and specialties. You must have technical application data for all types of motors, windings, and services. You need assurance that every form of insulation will be of uniform high quality . . . capable of withstanding the most severe demands of rated service.

Westinghouse Insulating Materials, stocked by over 100 Westinghouse Agents throughout the nation, meet those specifications. You can count on them to back up your own fine workmanship. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Dept. 7-N.

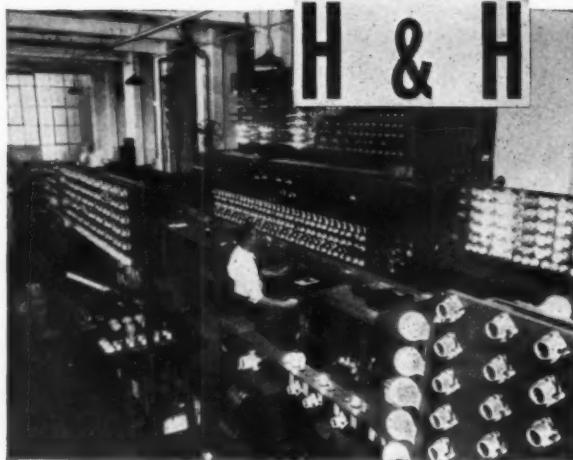
J-06318



Westinghouse

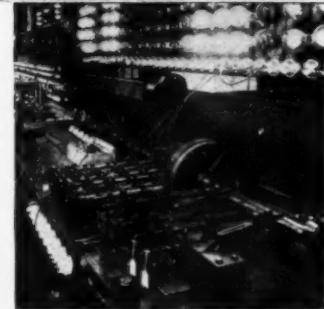
**INSULATING
MATERIALS**

TIME-TESTED 51 YEARS; LABORATORY TESTED EVERY DAY



Engineer making insulation or dielectric tests.
250 V. Snap Switches tested at 900 V., A.C.;
600 V. Switches tested at 1500 V., A.C.

H & H SWITCHES



Life-testing machines for
Tumbler Switches.



Non-inductive resistance load equipment.
For testing higher-rated switches
up to 600 Amps., 250 V.

FOR PRE-DETERMINED PERFORMANCE



Calibration of Circuit Breakers. Each
individual switch scientifically tested.



Synthetic load equipment for testing
the load limit of T-rated Switches.



Left: Electric oven for temperature tests. Right:
Calibrating first production samples of Circuit Breakers.



Calibration of Overload Relays. Each
individual switch tested and inspected.

If you look for RELIABILITY in Switches,
look for it first in the records of testing
machines! Here, Reliability is measured
in terms of load limits, cycles of opera-
tion with load, mechanical life-tests.

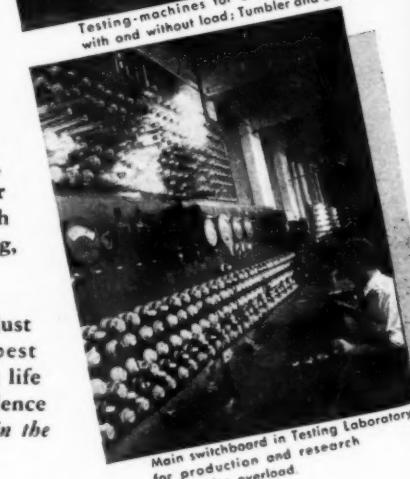
Reputation is built on the tests of USE.
But these tests of the Laboratory are still
more severe; more exacting than any
Underwriters or Federal requirements.

Just as the *past* reputation of H & H
Switches is a known quantity to you,
here its *future* is a known quantity too,
predictable from our test findings. Your
complete satisfaction with every switch
is pre-established by overload, heating,
insulation and mechanical life-tests.

H & H Switches, you see, are not just
sent out into the world with our best
wishes for a long life. Their long life
is PRE-DETERMINED, as your confidence
in them is assured-in-advance, *in the
laboratory*.



Inspection and production-testing of Magnetic
Switches, for perfect operating efficiency.



Main switchboard in Testing Laboratory
for production and research
tests under overload.

HART & HEGLAN DIVISION
THE ARROW-HART & HEGLAN ELECTRIC COMPANY, HARTFORD, CONN.

CONSERVE RUBBER



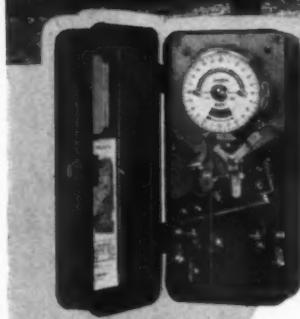
Use
PAPER or

VARNISHED CAMBRIC

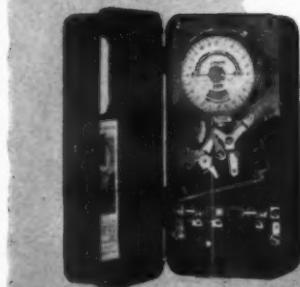
Serve the Nation's interests by conservation of all vital materials.
Rubber is extremely vital to all branches of the Service.

GENERAL CABLE CORPORATION

KEEP PROTECTIVE LIGHTING ON THE JOB *with* AUTOMATIC CONTROL



Form KAZ astronomic dial time-switch will continue to automatically change its setting in accordance with sun-set and sun-rise.



Current interruptions up to 10 hours will not stop Form VSWZ astronomic dial time-switch, nor affect its "on" and "off" settings.

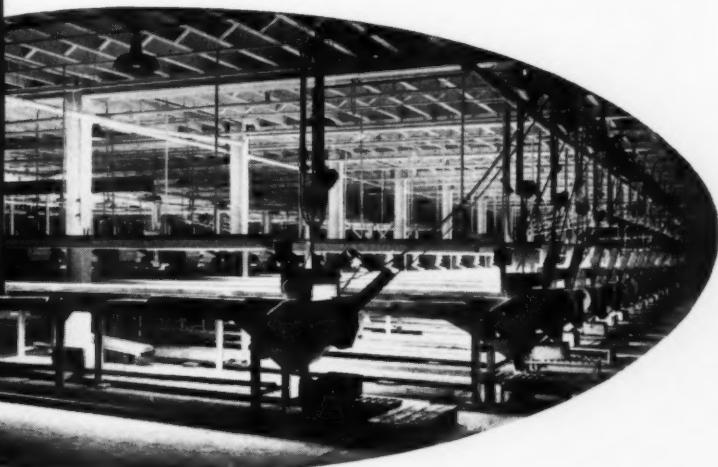
SANGAMO TIME-SWITCHES

The protection of vital property with lighting is now more important than ever before. To keep protective lighting systems on the job—unfailingly and punctually—that is the function of a Sangamo Time-Switch. With this fully automatic control the factor of human error is eliminated and lighting is operated when, where, and as long as it is wanted. Choose from the complete Sangamo Line, which includes astronomic dial, synchronous carry-over, and outdoor time-switches.

SANGAMO ELECTRIC COMPANY SPRINGFIELD
ILLINOIS

"O.K., Uncle Sam!"

**YOU ASKED FOR
SPEED**
*Here's how to
get it."*



Remove the shadows from every desk, drafting board and machine.

Flood every inch of working space with eye-comfort, economical • • •

Fluorescent CurtiStrip

Efficient, streamlined lighting in continuous, spot-free lines.

If your files do not contain complete information regarding Curtis Lighting ... write us today ... capitalize to the limit the tremendous opportunity for increased sales and service with Curtis lighting equipment.

Fluorescent CurtiStrip is
Listed by Underwriters'
Laboratories, Inc.



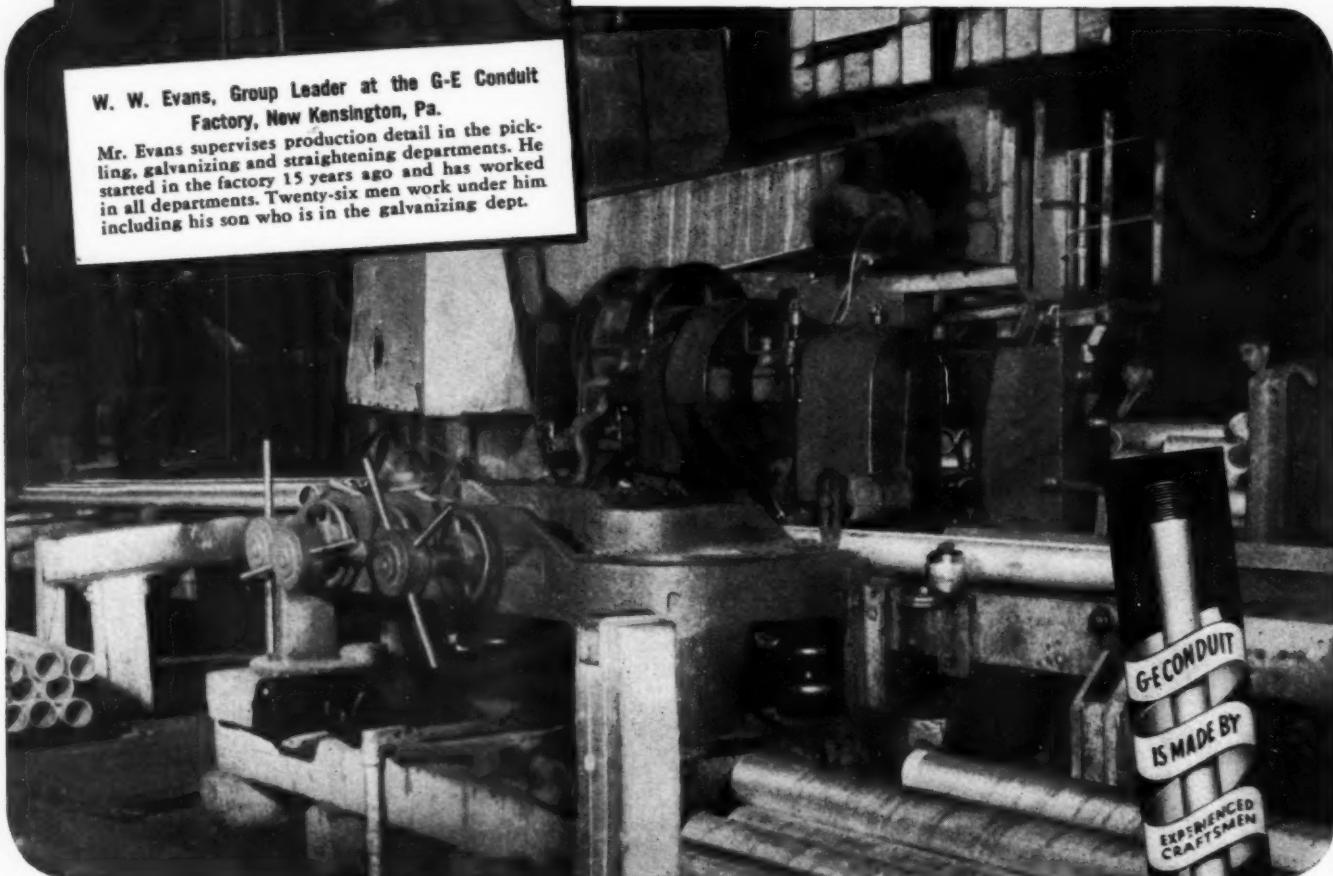
CURTIS LIGHTING, INC.
6135 WEST 65TH STREET, CHICAGO, ILL.

Every Piece of G-E WHITE CONDUIT Is Carefully Straightened

No. 5 of a Series—Men and Processes Behind G-E Conduit

W. W. Evans, Group Leader at the G-E Conduit Factory, New Kensington, Pa.

Mr. Evans supervises production detail in the pickling, galvanizing and straightening departments. He started in the factory 15 years ago and has worked in all departments. Twenty-six men work under him including his son who is in the galvanizing dept.



G-E White Moving Through Straightening Machine

THE straightening process demonstrates the minute care taken in making G-E conduit. It is really a "plus process" used with G-E White to remove any minor curvatures that might be caused during hot-dipped galvanizing. Consequently, G-E White is truly straight and therefore is easier to install and looks better.

The equipment used for straightening G-E White is modern. Like other equipment in the G-E conduit factory, it was developed through experience and research to meet definite requirements. Skilled workmen handle this process as they do all other processes in the factory. The spiral marks made on G-E White by straightening are symbolic of quality. They are visible reminders of the rigid specifications that G-E conduit meets during manufacture—in pickling, fluxing, hot-dipped galvanizing, etc., as well as in straightening.

For further information about G-E conduit see the nearest G-E Merchandise Distributor or write to Section C-181, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

GENERAL ELECTRIC

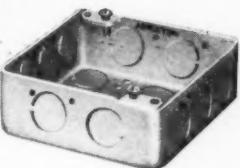
Every Minute Counts!

SAVE YOUR TIME—AND THE TIME OF YOUR MEN

by Specifying **APPLETON FITTINGS**

—the **COMPLETE Line**

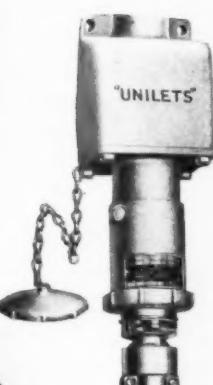
A FEW OF HUNDREDS
OF APPLETON TYPES



OUTLET AND SWITCH BOXES



THREADED AND NO-THREAD UNILETS



VAPOR-TIGHT LIGHTING FIXTURES



PLUGS AND
RECEPTACLES

EXPLOSION-PROOF AND DUST-TIGHT FITTINGS

A Type and Size for Every Requirement

There's no time to lose on the vital construction jobs that must come *ahead* of maximum war production. You'll save valuable minutes and hours by ordering Appleton fittings—first, because the *complete* Appleton line blankets every need; second, because Appleton manufacturing and distributing facilities are geared up to render unusual service, subject to priorities and allocations, during the period of emergency.

The unified control of Appleton fabricating plants and foundries insures a high degree of uniformity and exceptional quality throughout the vast Appleton line. Fitting bodies are smooth, rugged and expertly designed; additional time is saved on the job, through their ease of installation. They conform strictly to every code requirement.

Simplify ordering, make your jobs run smoother all the way; by specifying Appleton fittings—"STANDARD FOR BETTER WIRING!"

Sold Through Wholesalers

APPLETON ELECTRIC COMPANY

1704 WELLINGTON AVENUE

CHICAGO, ILLINOIS

Branch Offices: NEW YORK, 76 Ninth Avenue • DETROIT, 7310 Woodward Avenue • CLEVELAND, 824 Keith Bldg. • SAN FRANCISCO, 655 Minna Street • ST. LOUIS, 420 Frisco Bldg. • LOS ANGELES, 100 North Santa Fe Avenue • ATLANTA, 203 Luckie Street, N.W. BIRMINGHAM, 6 N. Twenty-first Street • MINNEAPOLIS, 305 Fifth Street, S. PITTSBURGH, 418 Bessemer Bldg.

Resident Representatives: Baltimore, Boston, Cincinnati, Dallas, Denver, Kansas City, Milwaukee, New Haven, New Orleans, Philadelphia, Seattle

APPLETON

CONDUIT FITTINGS • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

HERE'S WHY DEALERS CAN MAKE A THREE-WAY PROFIT ON

evidence . . .

"To eliminate Teletalk from the scheme of things here would be as drastic as a shift of plant operation to the horse and buggy days." Federal Products Corporation, Providence, R. I.

"The Teletalk system is saving the company \$2.50 per hour." Wal-McLain Company, Chicago, Ill.

"Teletalk has enabled us to arrange inter-department conferences without the individuals leaving their offices." Logansport Machine, Inc., Logansport, Indiana

"We have found Teletalk to be an indispensable means of instant intercommunication." Beech Aircraft Corporation, Wichita, Kansas

"We selected Teletalk because of its appearance and simplicity of operation." Pioneer Engineering & Mfg. Co., Detroit, Michigan

"We can contact individuals faster by using Teletalk than by any other means of communication." Republic Brass Co., Cleveland, Ohio

"Teletalk is one of the few installations of equipment that has done everything expected of it." Continental Car-Nar-Vac Corporation, Brazil, Indiana

REG. U. S. PAT. OFFICE 

● Here is a reproduction of part of a Teletalk advertisement which has recently appeared in Business Week.

It tells very emphatically how business has accepted Teletalk and what they think of it.

This acceptance is positive assurance to you that you can make profits selling Teletalk—a profit on Teletalk itself, a profit on the material necessary for its installation, a profit on the labor involved.

No other amplified intercommunication system on the market offers you a greater opportunity with which to meet the needs of retail stores, wholesale establishments, manufacturing plants, personal service organizations, institutions,

city, county, state and federal departments.

The speed-up in every line of business today requires the utilization of Teletalk intercommunication. The market is hot. The opportunity is great. Only a simple, intelligent analysis by you is necessary for you to capitalize on present conditions. You don't even have to look for new customers. Sell Teletalk to the customers now on your books. Make a brief survey of their needs. Put a demonstration in for a week. If you will do this in a sufficient number of places, the volume of orders you will get will surprise you.

Talk with any Teletalk distributor—you will find his name in your local classified telephone directory. If not, write direct.

Licensed under U. S. Patents of Western Electric Company, Incorporated, and American Telephone and Telegraph Company

WEBSTER ELECTRIC COMPANY, Racine, Wisconsin, U. S. A. • Established 1909.
Export Dept.: 100 Varick St., New York City. • Cable Address: "ARLAB" New York City

WEBSTER ELECTRIC

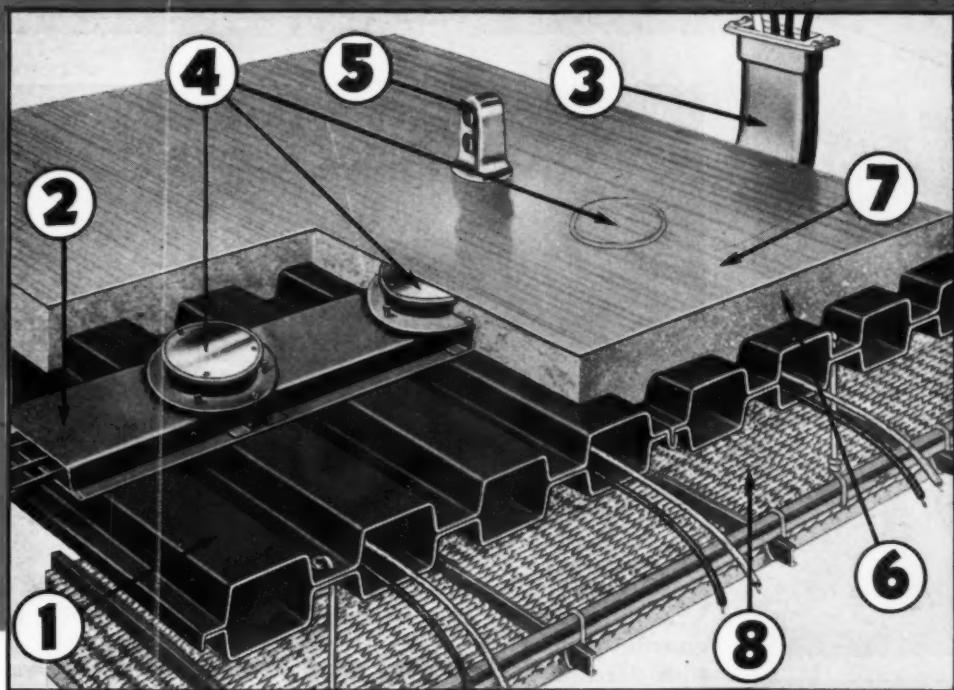
"Where Quality is a Responsibility and Fair Dealing an Obligation"



MANUFACTURERS OF TELEALK INTERCOMMUNICATION AND PAGING SYSTEMS • POWER AMPLIFIERS AND SOUND DISTRIBUTION EQUIPMENT • RADIO PHONOGRAPH PICKUPS • IGNITION TRANSFORMERS AND FUEL UNITS FOR OIL BURNERS

HOW Q-FLOORS MEET

ALL ELECTRICAL DEVELOPMENTS
OF THE FUTURE WITH ADEQUATE WIRING



Whatever the future will demand in electrical floor outlets, in all electrical services, you can meet it in buildings that are equipped with Q-Floors. And there are advantages for you as well as the building owner . . . Q-Floors cut down your overhead. With a uniform crew working continuously, there is less nonproductive labor with no reduction in productive labor and materials. The illustration and descriptions here tell the Q-Floor story. Additional data and estimates gladly furnished.

1 The Q-Floor section itself, made up of a series of cellular steel beams, is designed to carry any floor load. Each cell is a raceway for electrical wiring. Q-Floors are called "Quick-in" because the individual sections, two feet wide (4 cells) and any length up to 25 feet, can be laid on structural framework as fast as 32 sq. ft. in 30 seconds.

2 Crossover raceway carries wiring across and into the cells to and from main feed line—(3).

4 These are the handholes which provide easy access to the Q-Floor wiring.

5 Q-Floor electrical outlet which can be placed anywhere, any time, and moved in a few minutes. This is why Q-Floors are called "Quick-change."

6 Concrete fill over the Q-Floor section which can be covered with any floor surface material—such as carpet, linoleum, etc.—(7).

8 Suspended fireproof ceiling.

H. H. ROBERTSON COMPANY • FARMERS BANK BUILDING • PITTSBURGH, PA.

ROBERTSON Q-FLOORS

Guth 40th ANNIVERSARY OF LIGHTING LEADERSHIP!



**A Word from
EDWIN F. GUTH**
Pioneer &
Founder

As we reach the summit of this, our Fortieth Year, We see from our vantage point something more important than the satisfaction of accomplishments. In looking back, Nothing equals the heart-warming comfort we find in our hosts of friends, Friends whose confidence, loyalty, and assistance have made these Forty Years successful and happy. In looking forward Into the misty future with its uncertain shapes of things to come, We determine to make certain of your friendship. Our first ambition will be to continue to offer you quality products, dependable service and a human, understanding business policy.

CONSTANTLY, persistently, through 40 years of successful growth, we have *more than* kept pace with electrical progress. GUTH developments have contributed to the advancement of the entire industry.

Because we have been "Leaders in Lighting Since 1902", GUTH Products today represent your best selling and profit-making opportunity.

GUTH Fixtures sell easier because their superiority can be easily demonstrated, and they build continuous customer goodwill because of their sturdy construction and engineered design.

Throughout 1942, talk, show, and sell GUTH Fluorescent Lighting—the best fluorescent buy in America!

Illustrated above is the GUTH Excelux, one of the proven GUTH Leaders of 1941!

Other GUTH Lighting Achievements!



GUTH FUTURLITER — For Eye-to-the-Future
Fluorescent Planning



GUTH TRUCOLITE — Engineered efficiency
for greater economy and satisfaction!



Electrical Contracting

With which is consolidated The
Electragist and Electrical Record

Established 1901

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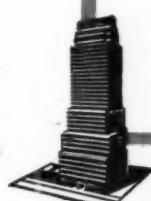
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A SERVICE PAPER for electrical contractors, engineers, motor shops, industrial electricians and inspectors, covering engineering, installation, repairing, maintenance and management, in the field of electrical construction—industrial, commercial, and residential.

McGRAW-HILL PUBLISHING COMPANY, INC.

JAMES H. McGRAW, Founder and Honorary Chairman

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New Horizons are coming into focus fast!

Anaconda quickens search for better wires and cables for American Industry and Defense

America is moving ahead at a faster pace. New industrial horizons are being reached and passed daily . . . thanks to the ingenuity of private research.

In the laboratories of the Anaconda Wire & Cable Company, for example, engineers are building longer life, greater current capacities, greater dependability in the power lines supplying electrical energy to vital defense machinery. But even when our defense goal is achieved, re-

search will be looking further ahead . . .

Tomorrow when peace comes, Anaconda Wire & Cable Company will be ready with not only many new products, but also many product improvements for those who have been denied them during the emergency period. There will be better wires and cables available for a better and greater era of industrial progress.

ANACONDA WIRE & CABLE COMPANY
General Offices: 25 Broadway, New York City
Chicago Office: 20 North Wacker Drive
Subsidiary of Anaconda Copper Mining Company
Sales Offices in Principal Cities



This familiar trademark
identifies Anaconda
products. It symbolizes
the best efforts
of man and science.

ELECTRICAL WIRES AND CABLES OF COPPER ARE THE LIFE LINES OF OUR NATION

ANACONDA WIRE AND CABLE

Electrical Contracting

IT'S EVERYBODY'S WAR

War is a full time job. The way is hard. For Americans, the goal is certain and eventual victory is sure. But what of our industry in the troubled days ahead? How shall we fare as individuals? These are sincerely selfish questions, but important. Because the electrical construction industry has much to contribute to the war effort and restrictions are rapidly shrinking familiar markets. The answers depend pretty much on how quickly we all realize the magnitude of the task. In electrical work it is too great an undertaking for individual effort alone.

It would be profitable, and fun, if each could go his own way, selling light and power and wiring to all, while folks have money and budgets are easy. The great commercial markets we have cultivated so aggressively are still here, closer and more urgent than ever. Yet, for a time, we cannot serve them all. For every pound of copper, every hour of labor is ear-marked for war and the civil defense.

Every ounce of energy our industry can muster is needed for wiring and lighting military cantonments and new factories, a wealth of new construction activity of boom proportion. Beyond this, there are plants to be converted for war work, with rewiring and lighting at the top of the list of urgent needs. All these must then be kept running, efficiently, 24 hours a day, seven days a week, from now on.

Can this job, in the tremendous proportions of 1942, be handled while business-as-usual, competition, job

hogging and all the ills of a segregated internally discordant industry prevail? Not a chance! It will take a thorough hatchet burying, personal and business sacrifices, followed by vigorous industry cooperation to swing it. Half measures won't do. Some will have to suffer, perhaps unfairly, and others may enjoy benefits their past records do not warrant. But we must work as an industry.

Total war demands total effort, from all the electrical construction resources in the land, welded together in each community so that all may serve. Can we bring the conflicting interests of contracting engineers, specialized contractors, motor shops, industrial electrical departments, and house wiremen together for any useful purpose? And what of the special interests of manufacturers and utilities?

Fair questions, but there are no conflicting interests today. In the following pages we have drawn a quick picture of the job ahead and some of the cooperative schemes available. Cooperation is the heart of emergency service work, too.

The problem is one for local leadership, probably within an existing association or league frame work. The important thing is that it must efficiently use every available skilled hand and mind. It can be done. Way back yonder some assorted folks from the four corners of the earth got together. They had fought bitterly against each other for centuries. They too, united for a cause. They made America.

JANUARY 1942



If you've been wondering: "Do I have to go to Washington to find out this or that about war-time construction or priorities?" — here's a chart to save your time.

Cities marked (1) have local offices of the Contract Distribution Division of the OPM, the branch charged with spreading defense work by means of contracts and subcontracts to smaller manufacturers.

Cities marked (2) have local offices of the Priorities Field Service of the Priorities Division of OPM. Their job is to assist in the field of priority ratings and allocations.

Cities marked (3) have local offices of the Training Within Industry Branch of the Labor Division, OPM... established to assist defense contractors with the problems of training the worker.

Week by week, as part of a decentralization program now under way, new local offices of these and other OPM divisions are being opened. In all of the cities marked with a "□" there's an easy way to find out the address of the nearest OPM office that handles your particular problem: That is by calling the local GRAYBAR office.

GRAYBAR long ago recognized the need for decentralized, local service. In each of the 87 "tagged" communities, GRAYBAR Representatives are intimately concerned with what's going on industrially. We count it part of our job, as a distributor in tune with the times, to try to supply you with *governmental* as well as *technical* information that will assist you in getting prompt delivery of the electrical supplies needed for national defense.

Graybar
In Over 80 Principal Cities
Executive Offices: Graybar Bldg., New York, N.Y.

- Akron
- Albany (1)
- Albuquerque (1)
- Allentown (1)
- Asheville
- Atlanta (1) (2) (3)
- Baltimore (1) (2) (3)
- Beaumont
- Birmingham (1) (2)
- Bismarck (1)
- Boise (1)
- Boston (1) (2) (3)
- Bridgeport (1)
- Buffalo (1) (2) (3)
- Butte • Casper (1)
- Charlotte (1) (2)
- Chattanooga (1)
- Chicago (1) (2) (3)
- Cincinnati (1) (2) (3)
- Cleveland (1) (2) (3)
- Columbia, S. C. (1)
- Columbus (1)
- Corpus Christi
- Dallas (1) (2)
- Davenport
- Dayton (1) (2)
- Denver (1) (2) (3)
- Des Moines (1)
- Detroit (1) (2) (3)
- Duluth • □ Durham
- Eau Claire (1)
- El Paso (1) (2)
- Erie (1)
- Evansville (1)
- Fall River (1)
- Flint
- Fort Worth
- Fresno
- Grand Rapids
- Hammond
- Harrisburg (1)
- Hartford (1) (2)
- Helena (1) (2)
- Houston (1) (2) (3)
- Huntington (1)
- Indianapolis (1) (2) (3)
- Jackson (1)
- Jacksonville (1) (2)
- Johnstown (1)
- Kansas City (1) (2)
- Knoxville (1) (2)
- Lancaster (1)
- Lansing
- Little Rock (1) (2)
- Los Angeles (1) (2) (3)
- Louisville (1) (2)
- Lowell (1)
- Manchester (1)
- Memphis (1) (2)
- Miami (1)
- Milwaukee (1) (2)
- Minneapolis (1) (2) (3)
- Montpelier (1)
- Nashville (1) (2)
- Newark (1) (3)
- New Haven (3)
- New Orleans (1) (2)
- New York (1) (2) (3)
- Norfolk
- Norristown (1)
- Oakland
- Oklahoma City (1) (2)
- Omaha (1) (2)
- Orlando
- Peoria
- Philadelphia (1) (2) (3)
- Phoenix (1) (2)
- Pittsburgh (1) (2) (3)
- Portland, Me. (1)
- Portland, Ore. (1) (2)
- Providence (1)
- Raleigh (1) (3)
- Reading (1)
- Reno (1)
- Richmond (1) (2)
- Roanoke
- Rochester (1)
- Sacramento
- St. Louis (1) (2) (3)
- St. Paul
- Salt Lake City (1) (2)
- San Antonio (1) (2)
- San Diego
- San Francisco (1) (2) (3)
- Savannah (1)
- Scranton (1)
- Seattle (1) (2) (3)
- Shreveport (1)
- Sioux Falls (1)
- Spokane (1)
- Springfield, Ill. (1)
- Springfield, Mass. (1)
- Syracuse (1)
- Tacoma • □ Tampa (2)
- Toledo (1) • Trenton (1)
- Tulsa (2)
- Washington (1) (2) (3)
- Wheeling (1)
- Wichita (1)
- Wilkes-Barre (1)
- Williamsport (1)
- Wilmington (1)
- Winston-Salem
- Worcester (1)
- York (1)
- Youngstown (1)





What Can I Do?

W.L.C.

EVER SINCE that Sunday morning when havoc swooped from the skies upon Honolulu, a new question has been churning about in millions of American minds. It is this: What can I do to help my country win this war?

This insistent question has pushed aside all matters of personal interest. From now on, individual wants and wishes must give way to the paramount needs of the nation. We all accept that. We have undertaken a huge job. Or, I should say, we have had a huge job thrust upon us. And unless we see that job through successfully it won't much matter what any of us may want.

That job is to win this war.

No longer are we trying to prepare for a war that we may get into. Today we are trying to win a war we're already in—and in up to our eyes. Nothing that any one of us now can do to help himself can get him very much if it does not also help our country to win this war.

I am sure that those who read these words will find many things to do. Some will enlist in the armed services. Some will become active in civilian defense. Some will labor to relieve distress in their home towns. Some will work with organizations set up to serve the men at the front. Each can and will find something he can do.

But this insistent question "What can I do?" goes beyond the individual and his personal service. It echoes through the offices and the shops of every American business concern. And what I have to say here is not directed toward individual effort. Rather is it intended for the men and women of American industry who make that industry a living part of American life. Today they are asking themselves: What can industry do? Or better still, what must industry do if our country is to finish the job it has started?

Those of us who work in and with American industry have one supreme obligation. We may feel very patriotic; we may be willing to serve "in any capacity;" we may be willing to sacrifice . . . if necessary. But if we fail to meet that one obligation, we shall fail our country in its time of need.

THAT SUPREME OBLIGATION IS AN HONEST DAY'S WORK, EVERY DAY, FROM EVERY MAN, EVERY WOMAN, EVERY MACHINE. . . .

IT IS AS SIMPLE AS THAT!

And that goes for all of us, whether we are engaged in civilian production or working directly on the weapons of war. American victory can be won only through the productivity of American industry.

Efficiency in production is not the responsibility of a few. It can be achieved only as we all put to useful purpose every minute of our time, every ounce of our energy, and every pound of our materials.

This responsibility of industry is the more vital because of what has happened to the business of making war. There was a time when success in war was chiefly a matter of well-trained, well-disciplined armies and competent leaders—when men were everything. In those days, military strength was a matter of strong battalions and able generals. Both still are vital. But today military might is essentially mechanical might. Modern war is an industry just as much as a factory or a railroad. In the first World War, mechanical equipment was relatively simple and limited. But today the special equipment of war and the expert skill needed to use it spell the difference between victory and defeat.

We Americans are not expert war-makers. That is why we must expect to suffer grievous losses before we can win substantial gains. We do not have military training and experience ready to hand when we need them. Neither do we have, ready for action, enough of the machines that are so essential to modern warfare.

So, when it becomes necessary to fight for our lives, we must start from scratch. And today, after a year's effort, we still are not ready to trade blow for blow with enemies who for years have schooled their leaders, trained and disciplined their people, and organized their industries to make war. We shall need more time to develop our strength. And while we are doing that, we must expect reverses.

But there is a brighter side to all this. For it follows that if we are granted this all-important time, the change in the method of warfare is right down our alley. The greater importance of mechanized equipment plays straight into the hand of the world's greatest industrial nation . . . if there is one thing America does know, it is industrial production! Our industries know how to produce. They have the skilled manpower. They have the organized facilities. Beyond any doubt, we can produce all that we need to win the victory that we must win—if only we are given the time.

THE FIRST RESPONSIBILITY OF THE ARMED FORCES IS TO GAIN THAT TIME FOR US.

THE FIRST RESPONSIBILITY OF INDUSTRY IS TO USE TO THE FULL EVERY SECOND OF THAT TIME IN PRODUCING THE WEAPONS

THE ARMED FORCES NEED TO WIN THE ULTIMATE VICTORY. INDUSTRIAL PRODUCTION IS THE KEY TO VICTORY. BUT IT MUST BE BIGGER PRODUCTION AND FASTER PRODUCTION THAN WE EVER HAVE KNOWN.

Heretofore American industry has worked to produce more of those things which make our lives more enjoyable. Today it must divert much of its energy from the products of peace to the weapons of war.

This change sets up a new yardstick of industrial performance. In time of peace we measure production efficiency in terms of money saved. From now on, we must measure efficiency chiefly in terms of time saved. For the plane, the tank, the gun, or the ship that is ready when it is needed to win a victory, is worth a million times more than the one that is delivered too late to avert a defeat.

Everyone knows how short we are of some materials and machines. But our most tragic shortage is the shortage of time. So whatever we may waste in the days ahead—and unhappily we are bound to waste plenty—let us never forget that the most deadly waste of all is the waste of time.

Time wasted never can be replaced. No one ever has discovered a substitute for time. If we would avoid the waste of this irreplaceable ingredient of victory, we must use every minute of it effectively—while we still have it.

That goes for us all. It goes for the man or the woman at the bench, at the desk, at the counter, in the field, or in the executive office. It goes for the politician as well as for the business man. It goes for the humblest and the most powerful. A nation at war cannot carry deadheads. It cannot spare a square foot for any one who will not pull his weight.

In this war, nothing short of complete victory can save the liberties of us all, rich and poor, employer and employee, haves and have-nots alike. The price of that victory is the labor, the loyalty, and the devotion of every last one of us. Winston Churchill said it well for the British people. You know how he said it. I need not repeat it.

All this imposes upon American industry, its owners, its managers, and its workers, the gravest responsibility they ever have assumed. If our country is to survive as a free nation, American industry must rise to that responsibility. If our country should fall, it would fall because American industry fell short of the need. It would be another case of "too little and too late".

This grave responsibility calls for the keenest management industry ever has known. It calls for unremitting research to make the most of our resources. It calls for the reduction of waste to a record minimum: that goes for waste of time, labor, and material. It calls for keeping our machinery working as near to full capacity as we can contrive. It calls for the highest rates of unit production we ever have known. That will mean skillful coordination by management and the most intelli-

gent cooperation that the men in the shops can give. It calls for inventive ingenuity to match that of a nation which has produced some of the world's outstanding technical genius. For this is a war of technical proficiency.

But above all, it calls for a new devotion to the day's work. For so long as we are at war, the day's work will determine our country's security.

Whatever may be our material resources and our technical skill, however resourceful our management, however broad the scale of our effort, industry cannot measure up to its prodigious responsibility if any of us shirk the day's work. Right there is where we find the one thing we all can do—the one thing that is within the power of each of us.

THAT ONE THING IS SIMPLY TO DELIVER AN HONEST DAY'S WORK WHEREVER WE ARE CALLED TO SERVE. HONEST WORK WILL WIN THIS WAR. LOAFING WILL LOSE IT. THE SHOWDOWN WILL BE WHETHER HITLER CAN DRIVE HIS PEOPLE TO WORK HARDER THAN WE ARE WILLING TO WORK. THERE IS NO ONE TO DRIVE US. WE MUST DRIVE OURSELVES!

Is that so much to ask? It is all our country asks of us, the men of industry. It is all that the men who must work the guns and tanks in the field ask of us. It is all that the men who work our ships and our planes ask of us. "Give us the planes, the guns, the ships, the tanks, and all the rest of our tools," they tell us, "and we'll give you the victory that means so much to us all. But, in the name of that victory, give them to us quickly—QUICKLY—QUICKLY!"

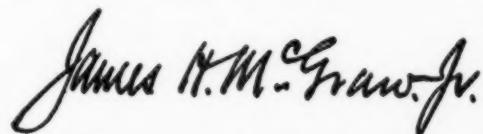
Is that, I repeat, too much to ask of us?

* * * *

To help American industry achieve ever-higher standards of efficiency has been the traditional mission of McGraw-Hill for three-quarters of a century. Normally that effort has been directed toward higher efficiency in the business of peace. But, as in the first World War, twenty-five years ago, it now is directed toward efficiency in the business of war and in every department of American effort that can contribute, directly or indirectly, to the achievement of victory.

And to that mission, I here pledge every resource of this company, its publications, its books, its staff, and every service it is qualified by experience and training to render to American industry, now enlisted in our common cause.

That is what we of McGraw-Hill can do. And that is what we shall do to our utmost.

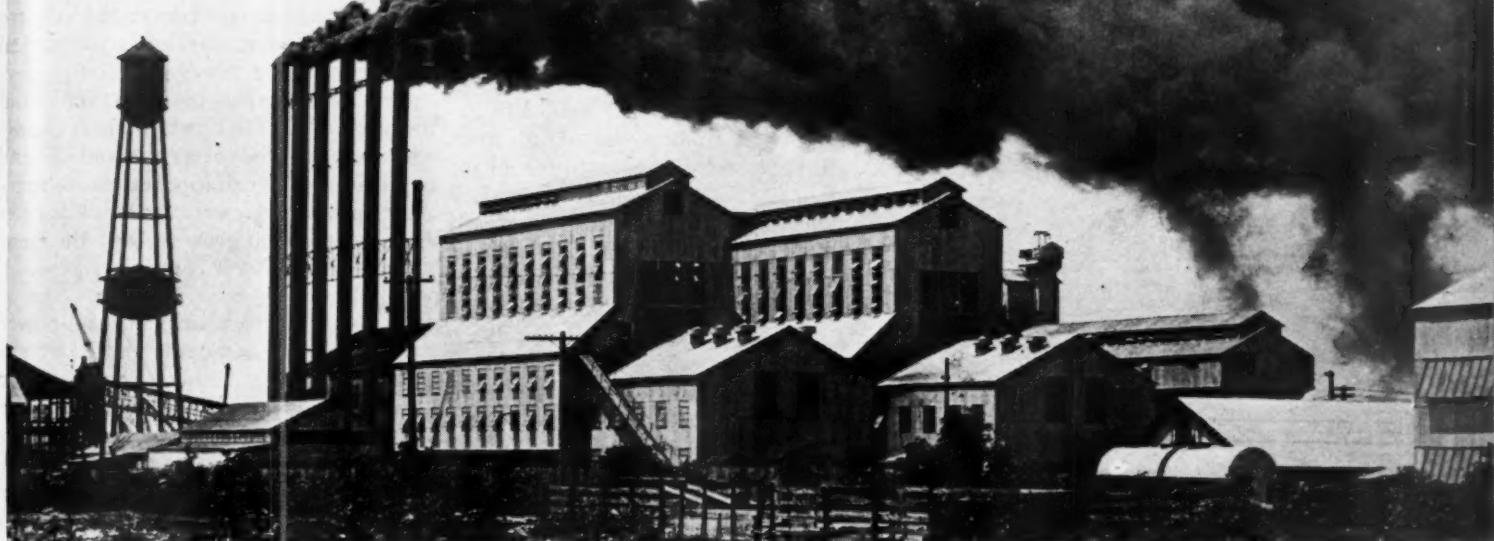


President, McGraw-Hill Publishing Company, Inc.





OUR JOB IN '42



The electrical construction industry faces war. What are our new responsibilities?

What are our opportunities? A review of our industry's stake in the troubled days ahead.

By W. T. Stuart

FROM a loose jointed, often reluctant, effort at creating a defense economy in 1941, America swings into an all-out job in 1942 with newborn national unity and, at last, a common goal. The electrical construction industry absorbed the tremendously increased burden of defense building in 1941 speedily and efficiently. It faces more trying days with courage, confident in its skills and proud of its strategic responsibilities in the great task that lies ahead.

The future picture is, in business prospects for our industry, optimistic. But "business as usual" is out for the duration. From a tolerated nuisance, priorities and allocation grew in 1941 to a business control of first rank importance. Joint ventures were created. Other cooperative plans were formulated. With the vast increase in defense born construction the latter part of the year saw a sharp reduction in building prospects in non-essential and commercial categories.

The electrical industry enjoys a market, however, beyond the immediate boundaries of new construction, in re-

wiring and modernizing existing plants for conversion to defense production. Protective lighting, intercommunication, utility expansion, repairs and maintenance are some of the other growing markets not directly linked with new building activity. And in new construction the hump of electrical wiring for light and power lags behind the peak of construction work from six weeks

to several months. An analysis of the coming year, therefore, follows construction prospects but with some time difference. The prospects outside of new construction activity further affects the overall picture.

The limiting and unpredictable factor in all 1942 activity is in priorities and allocations of scarce materials. As the general pattern approaches stability, the new demands of actual war production are expected to introduce new controls. In broad terms, allocations, or control of materials at the source will be applied

TABLE I
Approximations of the potential dollar volume of expected electrical construction work in 1942 on projects carrying priority numbers A-10 and higher.

PROJECTS	Estimated 1942 volume
Military establishment	\$153,375,000
Industrial Plants	125,360,000
Miscellaneous	14,000,000
Converting existing plants	24,600,000
Repairs and alterations	11,500,000
Housing	64,625,000
Total	393,460,000
Probable increase now being scheduled	100,000,000
	\$493,460,000



FIGHTING MACHINES are rolling off production lines that once served peaceful commerce. Conversion from peace to war needs power wiring alterations, 24-hour lighting, and skillful electrical maintenance.

to a wider range of basic materials and it is in this category that the most important changes in material control may be expected. The present trend of reports from OPM and SPAB indicate no radical changes in the present system of preference ratings or priorities. However, as this report is written, allocations and priorities are expected to go under direct military supervision.

While in previous years we could forecast our markets in terms of industrial, commercial and residential work and public demand, the outlook for 1942 calls for a different approach. Markets are delineated in terms of war needs along a scale running from munitions

at the top to non-essential civilian wants at the bottom. Outlining the prospects for electrical construction, alteration and repairs along a similar scale, therefore, gives a more nearly accurate picture of the task ahead.

Prospects for '42

1. The armament and munitions industries, to produce the actual guns, shells, and bombs, accounted for an important part of 1941 construction. It is expected that the war needs will greatly accelerate building in the coming months. Electrical construction activity will carry well through the building era on into the period of actual production as new machines are added and assembly lines speeded up. And this field of building activity will be expanded indefinitely in view of recent developments.
2. Military equipment industries have set out upon a huge building program. In 1941 a great many major projects were started, some completed far ahead of schedule. The bulk of electrical work on the tank and plane plants will come in 1942 as new construction plans are superimposed on those already underway. Some earlier predictions saw a slowing down in plant developments as production objectives were approached. The sudden shift to all-out war, however, has set in motion an enhanced building program, to meet new and vastly larger objectives in industrial production.
3. The military establishment for our armed forces both at home and abroad will be further expanded. No estimate can be made at this time on the amount of new construction or the electrical work that will be required. It is safe to say that the program will amount to at least a billion dollars more.
4. Beyond its immediate fighting tools and conveyances, modern war places heavy demands on all types of industries for supplies. The demand has been reflected in industrial expansion and modernization all over the country resulting in new demands on electrical contractors and heavy orders for electrical construction materials. Industrial expansion to fill direct military needs is also reflected in new building and extensive modernization in plants serving prime producers. And this market must continue to grow through the coming year.
5. Some of the added industrial power load cannot be adequately served by existing facilities. Utility companies over the nation are involved in a rapid power expansion program involving new plants and added distribution lines. A greater share of this work than ever before is being contracted to electrical construction firms. Before the declaration of war, it was predicted that the peak of this program as it affects electrical construction would be reached in July of 1942 or later.
6. Under the pressure of military needs and shortage of scarce materials for the civilian market a vast segment of American industry is converting its normal efforts to the war program. Plant conversion invariably requires alteration to the wiring systems. The early months of 1942 will see a rapid acceleration of this class of business for electrical contractors and industrial service shops.
7. Twenty-four hour operation and stepped up schedules demands the best possible lighting. Many plants, large and small, which have depended upon daylight with supplementary lighting will need high intensity fluorescent, mercury vapor, and incandescent lighting installations to hold production levels through night shifts.
8. The defense housing program permitted 100,000 occupancies under federal plants and 200,000 homes under private development to be scheduled for 1942. Authoritative reports indicate that this program is inadequate to meet urgent housing needs in overpopulated areas around existing plants. Before the declaration of war, an extension of the allotment to 525,000 homes was under consideration. With new plans in progress for designing homes with a minimum of scarce materials and the pressing need for de-

TABLE II

Blanket Priority Ratings Affecting Electrical Construction & Repair	
NUMBER	RATING
P-7 Merchant ship construction	A-1-b
P-14a,b Construction of ship ways	A-1-b,c
P-19a,b Construction of defense projects	As assigned
P-19c,d Defense housing	As assigned
P-22 Repairs	A-10
P-41 Construction, maintenance and operation of defense projects	A-1-a
P-46 Utility, maintenance, repair, supplies	A-10
P-47 Maintenance and repair of air transport facilities	A-3
P-56 Maintenance and repairs in mines	A-8
P-90 Production Requirements Plan, Supersedes D.S.R.P.	Varies

WHEN the defense program began to roll and the need for tools and dies increased, the Connecticut Tool and Engineering Company, Bridgeport, Conn., were in an enviable position. They had the experience, equipment, engineering talent and skilled workmen to do a bang-up job for Uncle Sam.

However, they felt somewhat cramped and wanted more space for expansion and new machinery to increase production efficiency. So they jumped the construction gun by purchasing an existing building and remodeled it, under the supervision of Fletcher-Thompson, Inc., architects and engineers, to suit their own requirements.

Although the long narrow structure has windows on four sides, the management wanted the best in lighting to supplement natural illumination and for night operations. The recommendations of the United Illuminating Company lighting engineer were accepted and Ray Walsh, local electrical contractor, installed an all-fluorescent system in both the shop and office areas.

High level general illumination of a maintained fifty foot-candle intensity is provided in the machine tool room. Four parallel rows of Miller continuous fluorescent troffers, totaling 336 feet, are suspended on ten-foot centers, nine feet above the floor. Each row is made up of eight-foot sections; each section contains two four-foot closed end reflectors mounted on continuous wiring channel. Each unit is lamped with two 40-watt, 3500° white lamps. Switch control is such that alternate units throughout the area can be turned on.

In the shop office and grinding room, where precision work is done, 70 foot-candles are maintained. The grinding room has 84 feet of troffer, split up into six parallel rows and mounted on 6-ft. 6-in. centers, nine feet above the floor. For the shop office, 28 feet of troffer, divided into three parallel rows on six-foot centers, is suspended at the same mounting height.

A novel feature of this continuous

HIGH LEVEL general lighting from fluorescent troffers increases efficiency and quality of workmanship in this tool and gauge plant.



... LIGHTING a Machine Shop

Fluorescent lighting speeds war effort, solves night shift problems in this tool manufacturing plant.

troffer system is the provision made for increasing the illumination intensity at a future date. Each reflector unit in the troffer is large enough to accommodate a third fluorescent lamp. The reflectors are stamped and punched to facilitate easy installation of the lamp sockets and the wiring channel is sufficiently large to take the additional auxiliary units.

The second floor offices are bathed with a maintained intensity of 50 to 70 foot-candles of light provided by Condi-Lite recessed fluorescent troffers mounted on four- to six-foot centers. The spacing and intensity depend upon the individual office layouts.

The protective lighting system consists of 1000-watt floodlights mounted on the building exterior to illuminate the fence line of the property. Incan-

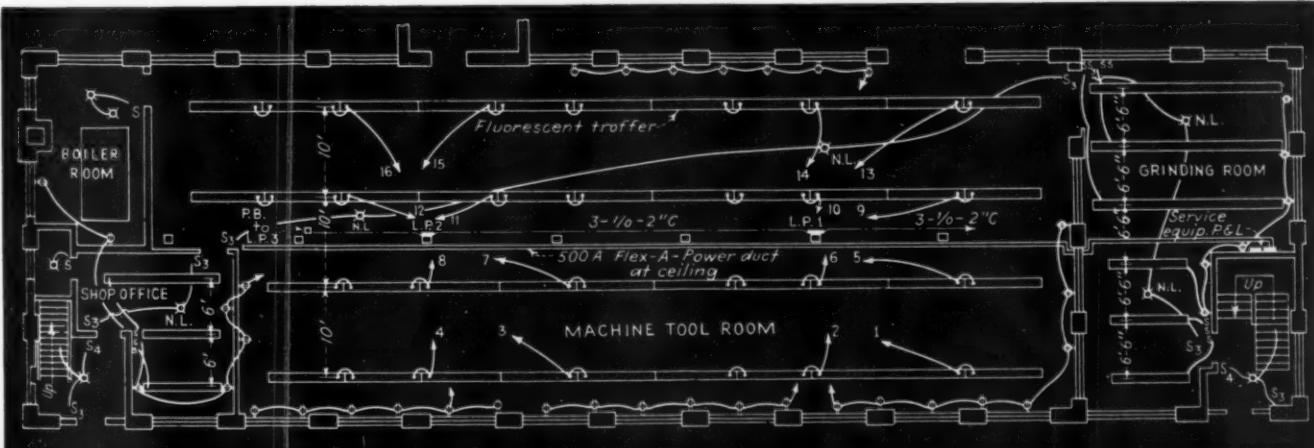
descent night-lights with three- and four-way switch control are spotted throughout the shop and office areas.

Power flexibility is provided by a line of 500-ampere Flex-A-Power bus duct located down the center of the machine room ceiling. Individual circuits for the motorized machine tools are taken from this line. Outlets are spotted along all the walls, at the work benches, for portable equipment.

The building is approximately 145-ft. long and 40-ft. wide. However, careful planning, foresight, modern equipment and a good lighting system has transformed this vacant building into a modern machine shop.

With subcontracting of war orders increasing, the remodeling of similar plants and buildings could do much to speed up our war effort.

LOCATION and spacing of the fluorescent units in the shop areas. Lighting control is at the panels and switches indicated.



ON THE ALERT

What electrical men can do for emergency alerts and blackouts—their local responsibilities before and after air raids.

NOW that war is here, everyone's responsibilities are altered. Everyone is on the alert. All activity must be directed to the war effort. And time is important. The electrical contractor holds a key position. His peacetime activities in new plant construction, existing plant reconditioning, housing and general electrical system maintenance are considerably increased under present conditions. In addition he has a purely wartime job—that of installing and maintaining emergency air raid and blackout equipment and the organization of an emergency service to keep plants operating under all conditions.

What are his responsibilities? First, he should know blackout methods and the overall operation of the air raid signal systems. Much detailed information on this score can be gleaned from the publication "Blackouts" published by the U. S. Office of Civilian Defense.

The Blackout Job

Let's consider "blackout". It is a broad term including the "alert" signal and the resultant darkening of the immediate territory. Here are some things the contractor can do.

Alarm systems are needed at strategic points throughout a city, town or plant to warn the inhabitants of an impending raid. Such equipment must be controlled from a central point and be operated by power from a utility line, a standby battery service, or manually if necessary. Equipment of this type is subject to all types of weather, hence must be protected against excessive heat or cold.

Communication systems are necessary between spotter positions and central air raid control offices, whether they are in cities, rural areas, or plants. Specially adapted intercommunicating telephone systems can be used in plants to assure all calls going through the central control office. This system might also be extended to raid shelters. Public address systems are useful for last minute instructions since they provide a means of reaching everyone in the shortest possible time. Duplicate circuits should be installed for emergency use.

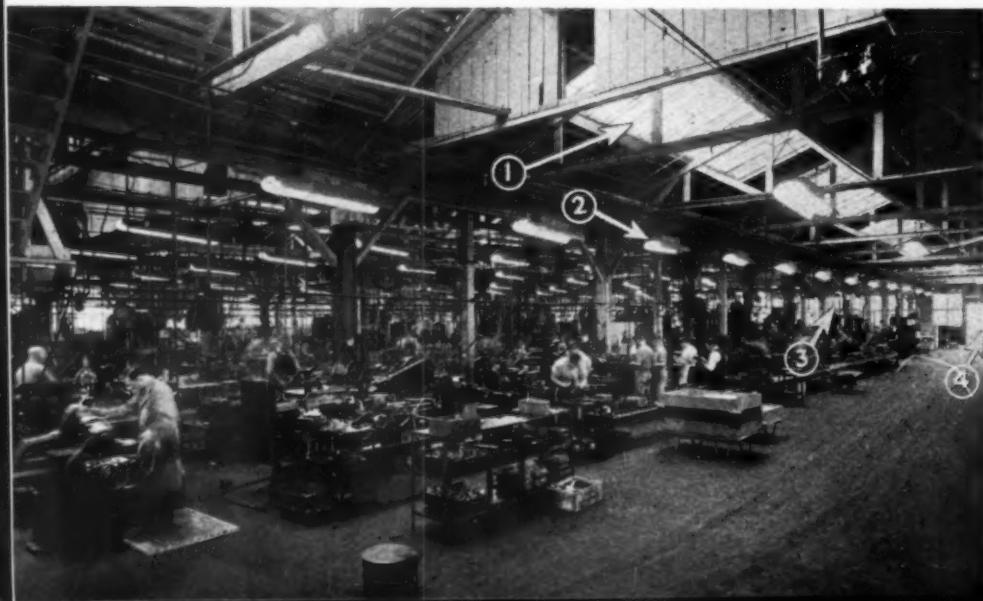
Light control of a centralized nature is essential for blackouts. Lights should be dimmed or extinguished entirely depending upon the emergency at hand and the strategy of the military and

civilian defense units. Street and highway lighting can be regulated by the operating utility or in some cities arrangements can be made for local control. But offices, stores, plants and homes present individual problems. Here the contractor can recommend individual outdoor switches to control store front and show window units, these to be operated by air raid wardens in the event the owner is negligent. The same type of control is applicable for plant outdoor and protective lighting, with dual central control points outdoors and indoors.

Single switch, centralized control of all lights in a building or plant is necessary for total blackout in case of an unheralded raid or splintered windows or walls. A system of energized contactors on individual lighting panels with a central control has worked out in English industrial plants.

The installation of motorized screens for industrial plants and other buildings can be used in plants where partial permanent blackout is employed. This method allows daylight in the plant when the screens and shutters are opened. The expense of this system is offset by the savings in electric energy over the total blackout plant. One English plant permanently blacked out alternate windows and used the motorized screens on the others. By doing this they were able to completely cover 550,000 sq. ft. of glass in 15 seconds.

Total interior blackout systems should be provided with a low voltage pilot light circuit to enable employees to find



BLACKOUT POINTS in the industrial plant. (1) Skylights and light monitors. (2) Centralized control of lighting. (3) Windows. (4) Doors and loading platforms. Skylights and windows can be permanently obscured or equipped with motor operated shutters or blinds. Doors and platforms should be equipped with light locks.

ELECTRICAL CONTRACTORS MUST BE PREPARED TO:

Advise on blackout methods
Provide accessible switching
Centralize light control
Protect against sabotage
Install air raid signals
Provide communication systems
Equip emergency trucks
Cooperate with local officials

EMERGENCY TRUCKS SHOULD CONTAIN

Rubber blankets and mats
Rubber gloves
Several 50-ft. extension cords
Several sizes of jumper cables
Large assortment of cable connectors
Hook sticks
Ladders
Miscellaneous tools
Miscellaneous tapes
Weatherproof portable floodlights
Clocks and tackle and chain hoists
Portable "A" frames
Bolt cutters
Cable twine
Miscellaneous insulators
Rope
Gasoline driven emergency generator

electrical contractor is the logical person to set-up such an emergency organization. He has the talent, equipment and experience of doing changeover jobs to enable him to restore service quickly and efficiently. He should equip a service truck with the necessary equipment, including a gasoline driven generator set to take care of temporary lighting or essential small power loads.

In heavy industrial areas, contractor organizations might combine the efforts of several individual contractors, equipped with a number of such emergency trucks on 24 hour call. These organizations, as well as the plant electrical departments might well set up portable secondary distribution centers to replace any that may have been hit by enemy action. These units, containing a bus trough and disconnect switches, could be rolled into place and used until repairs are made.

Sabotage Protection

Electrical systems are vulnerable to acts of sabotage. Contractors know this and know what parts could be effectively protected. They are in a position to make helpful suggestions.

For example, outdoor substation enclosures could be re-enforced with sheet steel to protect against bomb fragmentations or high powered rifle bullets which might puncture transformer casings. Remote oil level indicators with suitable alarms might be located in the chief engineer's office to indicate leakage of transformer oil.

Large scale emergency service of this type requires cooperation between utilities, the plant electrical departments and between contractors themselves. It's more than a one man or one company job. All efforts must be keyed to the one purpose—maintenance and restoration of service and operations.

It's going to mean intensive study, planning and training, but it can and must be done. The contractor is the standby on which industry can depend.

1 HINGED SHUTTERS obscure light panes in sawtooth roof construction. They can be manually controlled or motor operated with one central control station. Wire mesh on the interior of windows prevents shattered glass from showering workers.

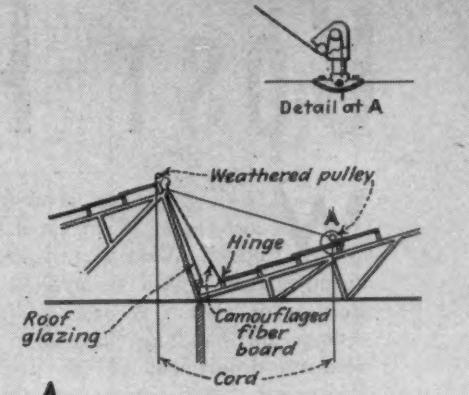
2 CAMOUFLAGED TARPAULIN, inside roller blinds and protective wire mesh screen comprise the blackout scheme for hipped roof monitors. Roller tarpaulin and blinds can be motorized with central control.

3 LIGHT LOCKS of the single inside type obscures light in doorways of drug stores and similar businesses that must be kept open during an emergency.

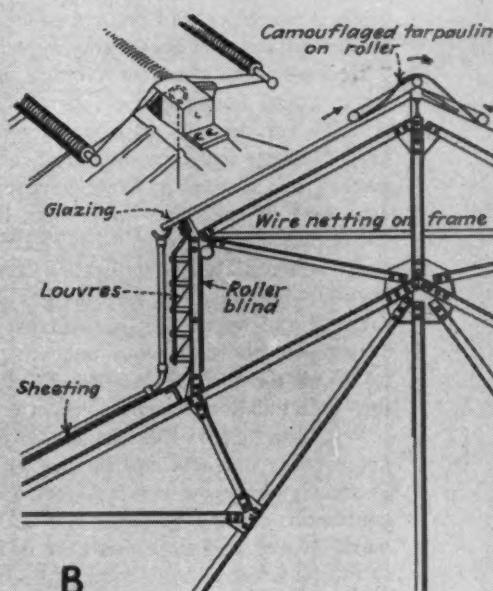
Emergency Service

What if a plant is hit during a raid? What if several vital points of the electrical system are put out of commission? Can the plant crews be divided to take care of their regular duties as well as the emergency repair duties? Or should the management be able to utilize outside assistance?

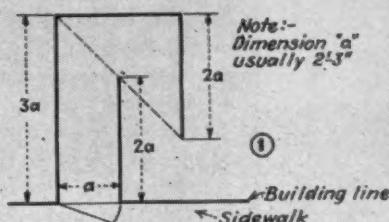
Such outside help would expedite the return of normal plant operations. The



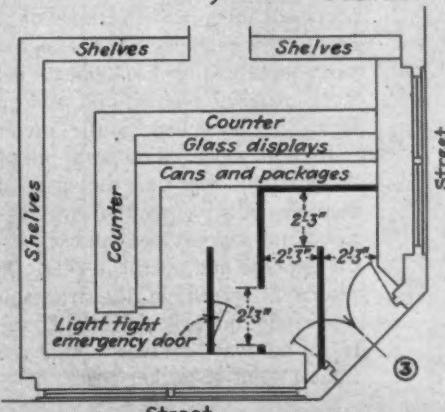
A



B



C



COST PLUS PERCENTAGE

WHAT is a fair mark-up for cost-plus? What about labor-only? What part of the management cost should be applied as a function of labor? What is a fair percentage for handling materials? The research department of the Electrical Contractors Association of Chicago went to work on these problems and from a collection of carefully audited business statistics and reports produced the analysis in the accompanying table.

Because there are few average contractors and few average jobs the detailed operating and management costs of percentage work in industrial, commercial and alteration fields have been expressed in minimum—maximum limits, within which most normal electrical construction activities will fall. Consequently, the detailed percentages for each of the operations noted must be adjusted to the conditions on each job to which the method is applied and to the individual contractors experience.

With the help of this chart, cost-plus percentage contracts can be drawn up to clearly show the services which the contractor expects to perform. And a mark-up can be established that is fair to the customer and the contractor alike.

Particularly interesting is the treatment of labor-only work. It will be noted from the table that several items under cost of handling materials have been extended into the labor-only column. The material handling costs on labor-only jobs are expressed, however, as a percentage of labor, by assuming a fixed ratio of 1 to 1.5 as material is usually 50 per cent more than labor.

Basically the study renders the operating cost of electrical installations, as established by a number of accurate overhead studies, in terms of services performed on the job. A suggested proposal form and method of billing designates each item of expense plus percentage involved. Duplicate invoices, stock material requisitions, and pay roll forms are attached to the invoice.

In both negotiation and billing, the Association reports, the use of this method will insure the owner a fair price and support the contractor's claim for expense and overhead cost. The net return or profit in the transaction is separately quoted and billed, and thus is in no way confused with the contractor's out-of-pocket cost.

War won't wait for lump sum bids. Fee and percentage quotations must be fair and equitable. A timely guide for negotiating war industry jobs.

STATEMENT

Installing electrical work as per contract—Work installed May 1st to May 7th inclusive

MATERIAL

Costs as listed.....	\$479.00
Service charges	11.98
General overhead and administrative costs.....	31.20
Total cost of material.....	\$522.18

LABOR

Labor as listed	\$339.00
Labor burden (supervision, tools, insurance, etc.) 23.40 per cent	78.82
General overhead and administrative costs (18.5 per cent).....	62.60
Total cost of labor.....	\$480.42
Total cost of work.....	\$1002.60
Net return	100.26
Amount of bill.....	\$1102.86

PROPOSAL

MATERIAL:—Items shown in percentage of material cost.
Service charges

1. Selecting and purchasing.....	1.25
2. Following up and coordinating delivery.....	.75
3. Providing storage facilities.....	.30
4. Cartage and special deliveries.....	.20
Total service charges.....	2.50
General overhead and administrative expense.....	6.50
Total cost of handling material.....	9.00
Net return	10.00

LABOR:—Items shown in percentage of wages paid.

Labor burden	
1. Supervision	3.20
2. Liability and miscellaneous insurances.....	12.50
3. Tools and equipment (consumed and depreciated).....	3.80
4. Cartage (tools) .....	.15
5. Study time and layout (shop drawings)	
Field engineering	
Drafting and blue printing (shop drawings)	3.75
General overhead and administrative expense.....	23.40
Net return	18.50

Total expense of handling labor.....	41.90
Net Return	10.00

NOTE: If the customer elects to buy his own materials, there will be an additional 10 per cent added to the labor handling cost. This 10 per cent is material service charge. Regardless of who purchases the material, the contractor assumes responsibility in connection with the proper selection, delivery, storage, installation and operations of same.

TYPICAL PROPOSAL states precisely the services to be performed and the percentage added for each. For "labor only" additional charges are frankly labeled "material service".

**DIVISION OF OPERATING COSTS FOR ELECTRICAL INSTALLATIONS
SHOWN IN PERCENTAGE OF COSTS OF MATERIAL AND LABOR**

ITEMS OF EXPENSE	INDUSTRIAL WORK			COMMERCIAL WORK			ALTERATIONS—COMMERCIAL		
	LABOR & MATERIAL FUR. BY CONTR.	LABOR ONLY BY CONTR.	LAB. & MAT.	LABOR ONLY	LAB. & MATERIAL BY CONTR.	LABOR ONLY	LAB. & MATERIAL BY CONTR.	LABOR ONLY	LAB. & MATERIAL BY CONTR.
JOB REQ. 5 TO 25 ELECT.	JOB REQ. 25 TO 50 ELECT.	5 TO 25 ELECT.	5 TO 25 ELECT.	5 TO 25 ELECT.	5 TO 25 ELECT.	5 TO 25 ELECT.	JOB REQ. 5 TO 25 ELECT.	JOB REQ. 5 TO 25 ELECT.	5 TO 25 ELECT.
ENG. BY OTHERS ENG. BY CONTR.	ENG. BY OTHERS ENG. BY CONTR.	ENG. BY OTHERS	ENG. BY OTHERS	ENG. BY OTHERS	ENG. BY OTHERS	ENG. BY OTHERS	ENG. BY OTHERS	ENG. BY OTHERS	ENG. BY OTHERS
APPROX. SEE APPROX.	SEE APPROX.	SEE APPROX.	SEE APPROX.	SEE APPROX.	SEE APPROX.	SEE APPROX.	SEE APPROX.	SEE APPROX.	SEE APPROX.
MIN. MAX.	MIN. MAX.	MIN. MAX.	MIN. MAX.	MIN. MAX.	MIN. MAX.	MIN. MAX.	MIN. MAX.	MIN. MAX.	MIN. MAX.
ENGINEERING & LAYOUT	—	5.00 7.00	—	—	4.50 6.50	—	—	—	—
SELECTING & PURCHASING	1.00 1.50	0.75 1.00	0.75 1.25	0.50 0.75	0.50 1.00	0.40 0.80	1.00 1.50	0.50 1.00	—
FOLLOW UP & COORD. DELIVERY	0.50 1.00	0.30 0.50	0.40 0.80	0.25 0.40	0.10 0.20	0.10 0.20	0.50 1.00	0.20 0.40	0.50 1.00
CARTAGE & SPECIAL DELIVERY	— 0.25	— 0.25	— 0.15	— 0.15	—	—	0.50 1.00	—	0.50 1.00
STORAGE FACILITIES (FIELD)	0.04 0.50	0.04 0.50	0.02 0.40	0.02 0.40	— 0.30	— 0.20	0.04 0.50	— 0.25	0.04 0.50
GEN. OVERHEAD & ADMIN. EXP.	5.65 10.60	4.55 8.50	4.80 8.80	2.26 4.24	1.82 3.41	1.60 3.27	8.50 15.80	8.50 15.80	8.50 15.80
TOTALS	7.19 13.83	11.74 19.85	5.72 11.10	10.07 17.00	2.86 5.74	2.32 4.61	8.84 17.20	3.42 6.72	10.54 20.30
I COST OF HANDLING MATERIALS①									
SUPERVISION	2.60 3.80	2.54 2.88	2.44 2.88	2.80 2.60	2.80 3.80	2.52 3.42	2.86 3.52	3.20 3.80	4.00 5.00
TOOLS—CONSUMED & DEPR.	3.50 5.70	3.50 5.70	3.00 4.00	3.00 4.00	3.50 5.70	3.00 4.00	3.50 5.70	3.50 5.70	3.00 4.60
FIELD SHOP TOOLS	— 0.12	— 0.12	— 0.10	— 0.10	— 0.12	— 0.10	— 0.12	— 0.12	— 0.15
CARTAGE (TOOLS)	0.10 0.20	0.10 0.20	0.10 0.15	0.10 0.15	0.20 0.30	0.20 0.25	0.15 0.20	0.25 0.30	0.35 0.45
FIELD OFFICE & SHOP BLDG.	— 0.50	— 0.50	— 0.30	— 0.30	— 0.50	— 0.30	— 0.50	— 0.50	— 0.17
ENG. LAY OUT, & STUDY TIME	—	—	5.00 7.00	—	5.00 7.00	2.00 4.00	2.00 4.00	1.00 2.00	6.00 8.00
FIELD ENGINEERING	3.20 6.40	2.40 4.80	3.20 6.40	2.40 4.80	2.40 4.80	2.40 4.80	3.20 6.40	4.00 8.00	3.60 6.40
FIELD TELEPHONE	— 0.14	— 0.14	— 0.14	— 0.14	— 0.14	— 0.14	— 0.20	— 0.30	— 0.40
BLUE PRINTING & JOB STATIONARY	0.08 0.12	0.08 0.12	0.08 0.12	0.30 0.50	0.30 0.50	0.30 0.50	0.10 0.15	0.20 0.30	0.40 1.00
TRAVEL EXP.—OFFICE TO JOB	0.15 0.35	0.15 0.35	0.10 0.25	0.10 0.25	0.30 0.50	0.15 0.25	0.25 0.35	0.35 0.50	0.50 0.60
GEN. OVERHEAD & ADMIN. EXP.	1.48 2.10	1.48 2.00	12.00 17.00	11.30 16.00	16.00 26.50	15.00 21.20	16.50 23.20	18.00 25.50	21.00 31.80
TOTALS	24.49 37.93	27.73 41.61	20.92 31.34	24.16 35.46	30.00 46.96	25.75 38.96	27.56 42.34	32.50 50.10	45.30 51.51
LABOR ONLY JOBS—ADJ EXP. OF CHGS&MATERIALS	—	—	—	—	4.29 8.16	3.48 6.62	5.13 10.68	6.62 15.02	—
TOTALS—not incl. INS.	24.49 37.93	27.73 41.61	20.92 31.34	24.16 35.46	34.28 55.02	29.05 45.58	27.56 42.34	37.63 50.16	51.92 51.47
INSURANCES	—	—	—	—	—	—	—	—	—
TOTALS	—	—	—	—	—	—	—	—	—

NOTES—
 ① THE FIGURES IN THESE TABLES ARE BASED ON SURVEYS AND STUDIES MADE BY THE FOLLOWING—
 DUN AND BRADSTREET — 1934
 DUN AND BRADSTREET — 1935
 NATL. ELECTR. CONTRS. ASSN.— 1937
 ELECTR. CONTRS. ASSN. OF PITTSBURG — 1928
 (SURVEY BY A. H. BLASE CO., AUDITORS)
 ELECTR. CONTRS. ASSN. OF CHICAGO — 1939
 ELECTR. CONTRS. ASSN. OF CHICAGO — 1940

② CONTRACTING (ELECTR.) IS A SERVICE TRADE WITH THE SUPPLYING & MANAGEMENT OF LABOR AS THE PRIMARY FUNCTION. MATERIAL IS INCIDENTAL AND REGARDLESS OF WHO PURCHASES IT, THE CONTRACTOR ASSUMES RESPONSIBILITY IN CONNECTION WITH THE PROPER SELECTION, DELIVERY, STORAGE, INSTALLATION, AND OPERATION OF MATERIALS PROVIDED TO SERVICES RENDERED

③ FILL IN VACANT COL. WITH PERCENTAGES TO FIT THE PARTICULAR JOB BEING CONTRACTED

④ IT IS ASSUMED THAT THE COST OF MATERIAL WILL BE 50% GREATER THAN THE COST OF LABOR, OR THAT 1% OF MAT. COST IS EQUAL TO 1.5% OF LAB. COST. FOR LABOR ONLY PROJECTS, 1.5 TIMES THE PERCENTAGE SHOWN UNDER MAT. HANDLING (ITEM 1) MUST BE ADDED TO LABOR (ITEM II)

ELECTRICAL CONTRACTORS' ASS'N.
OF CITY OF CHICAGO
R.W.A.

JUNE 14, 1941

LOAD CENTER

WITH materials scarce and time the essence of every contract, industrial power distribution methods emphasize primary feeders and load center substations for copper economy, flexibility and convenient layout.

INTEREST in primary voltage power distribution systems for industrial plants is the logical outgrowth of increased power and lighting loads. But the installation of such systems has been hampered by the dangers inherent in high voltage equipment and space consuming protective barriers. The recent development of standard fully enclosed and protected substation equipment specially designed for installation in factory production areas, however, has opened the way to more general use of this flexible and copper saving system in war industry.

In conventional methods of distribution, large blocks of power are transformed in one large substation from high voltage to utilization voltage; the primary voltage ranging from 2.3 to 15 kv., and utilization voltage being of the order of 120 to 600 volts. Power is distributed throughout the plant at low voltage from one large substation.

The load center form of electrical distribution system, which has been applied to certain parts of electric utility systems, is ideally adapted to industrial plants and offers many improvements over existing methods for industrial power distribution systems.

Load center distribution differs from the existing form in two ways:

1. The step-down substation is located near the center of the load area.

DISTRIBUTION CUBICLES are located at load center with transformer adjacent. Design permits safe installation in production areas without special precautions.

2. When the total load is above 300 to 1,000 kva., depending on secondary voltage, the load area is divided into two or more sections with a small step-down substation at the center of each area.

A comparison of the old and new methods can best be made with a typical medium-size factory, which has a demand of 3600 kva., a load density of 10 volt-amperes per square foot, and is supplied from a utility over two 11 kv. lines. The utilization voltage is 480 volts. The building is assumed to be approximately 570 by 640 ft. In this example, both systems are designed to carry all load in case of a transformer or feeder failure. Comparative electrical layouts are shown schematically in Chart 3.

Installed Cost

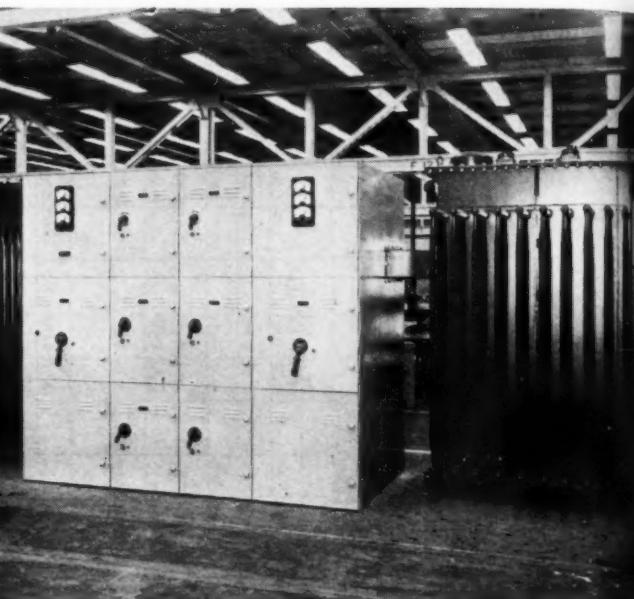
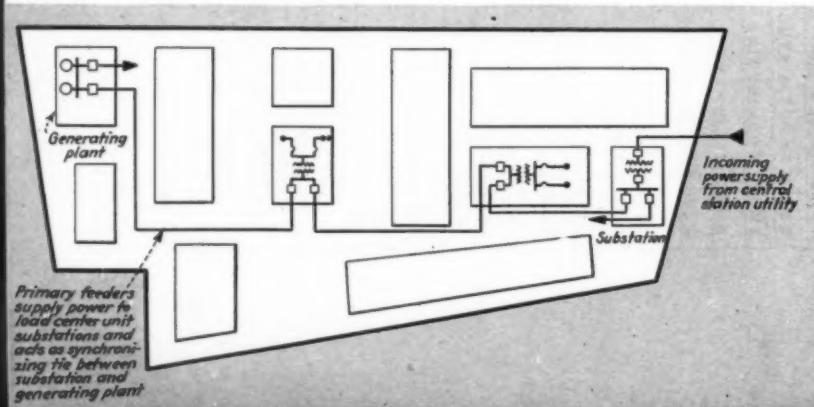
The installed cost of the secondary distribution arrangement is approximately \$102,000, whereas, the cost of

the load center arrangement is \$75,000 resulting in a saving of \$27,000. As the size of the factory increases, these savings become greater. In small factories there is still a material saving. However, it may be less than shown above.

The transformers for a load center distribution system cost more than for the conventional arrangement. However, there is a saving in secondary switch-gear and secondary copper because the short circuit currents accompanying the secondary faults on the small load center transformers are materially lower than the current accompanying the very large transformers of the conventional arrangement. Lower short circuit currents require less interrupting capacity in secondary air circuit breakers, hence the lower cost of secondary switchgear.

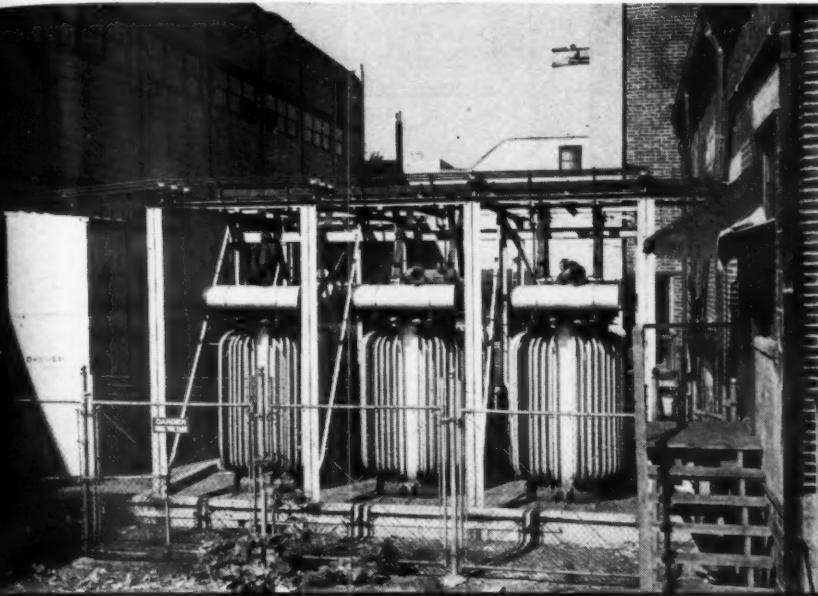
The transmission of power from the large substation to the load area by low voltage, as in the older methods, requires many times the copper needed to transmit the same amount of power by high voltage to the unit substations of the load center system. Thus the use of the latter system results in a large saving in copper which is vital to our war program.

Because the substations of load center distribution are small, they can be added when and where needed without exten-



R D I S T R I B U T I O N

By
D. L. Beeman
*Industrial Engineering Dept.,
General Electric Co.*



CONVENTIONAL SUBSTATION design frequently requires long secondary feeders of heavy copper originating at a considerable distance from the load center.

sive planning or forecasting. This is compared with the older method which requires a comprehensive forecast of the location and magnitude of the load in order to select the most advantageous location of the large substation. Furthermore, standardization is possible with small units and standard specifications are available.

The load center units are completely coordinated in the factory. To install them it is necessary (1) to lay a concrete pad with conduits in place for cable leads, (2) to place the load center unit substation on the foundation, and (3) to make cable connections.

The shorter secondary runs accompanying the small unit substation reduces voltage losses and results in improved performance of motors and lamps.

Load center unit substations are available in standard sizes ranging from 100 to 2000 kva, and when required, larger units are available. The optimum size of the load center unit substation is actually determined by economics. There may be other considerations in special cases, but for this discussion economics alone will be considered. The smaller load center units are more expensive, because small equipment is inherently more expensive per kva. A small unit substation requires the same amount of primary switchgear as a larger one,

hence this factor tends to favor larger transformers.

The larger load center units become increasingly expensive because of the large secondary switchgear needed to handle the high secondary short circuit currents accompanying large transformer banks. The larger unit substations require more secondary copper. For given load density the only way to obtain load for the larger unit is to serve a larger area. Hence, secondary runs become longer than for smaller units.

On the other hand, since fewer large substation units are needed the amount of primary cable required is less as compared with the greater number of small unit substations needed.

The combined installed cost of primary switchgear, primary cable, unit substations, and secondary cable, plotted as a function of the size of the unit substation, is shown in Chart 2. Curve "A" shows that the optimum size for a 480-volt secondary is 600 to 1000 kva.

Lower secondary voltages such as 120/208 or 240 volts involve more current per kva, hence more secondary copper and larger secondary switchgear. Therefore, the optimum size of the unit substation is smaller than at 480 volts, ranging from 300 to 600 kva. This relationship is also shown graphically.

[Continued on page 110]

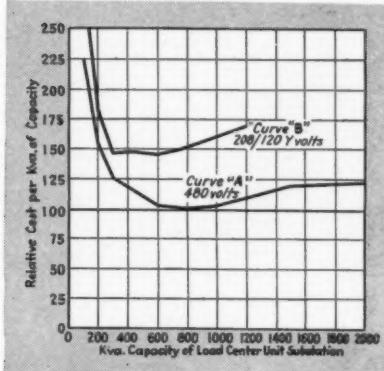


FIG. 2. RELATIVE COSTS of unit substations in terms of capacity per unit. Optimum sizes are between 300 and 1000 kva, depending upon the secondary voltage.

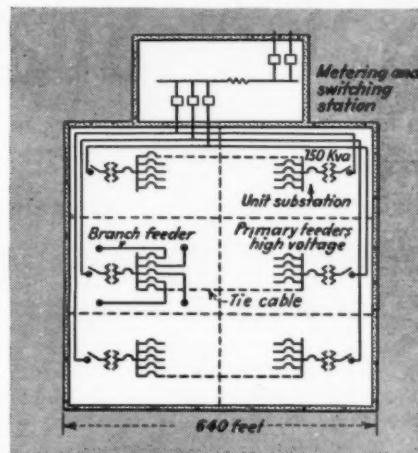
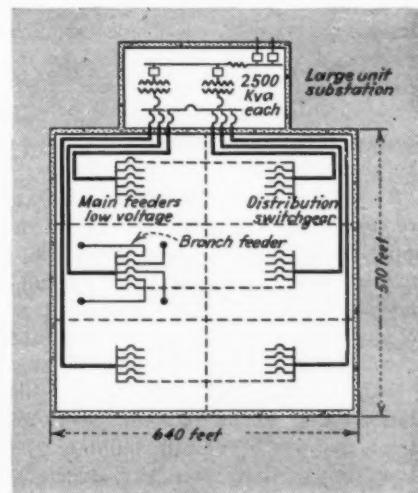
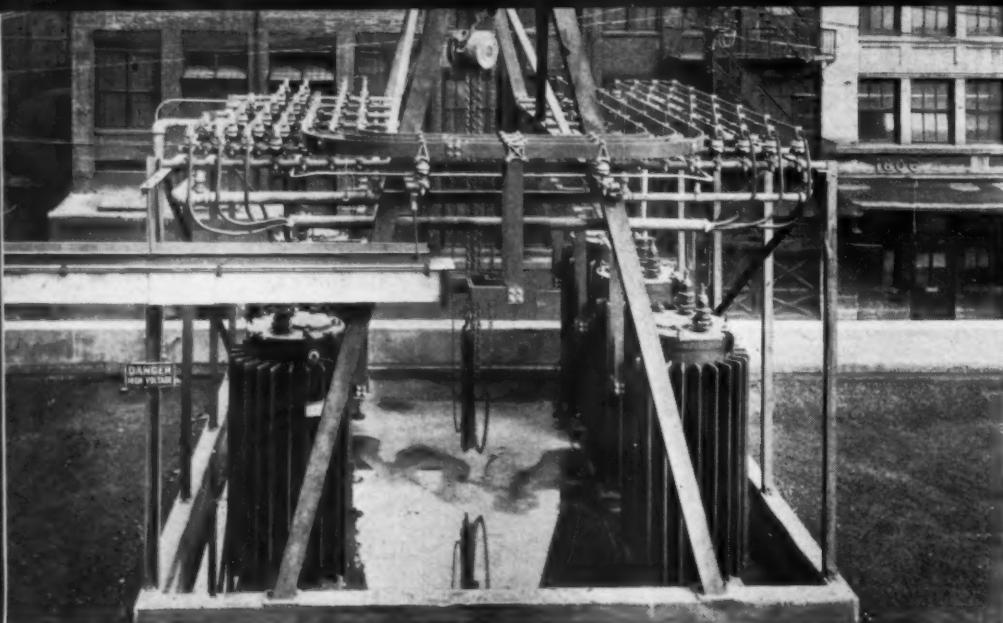


FIG. 3. LOAD CENTER substation system compared with secondary feeder system. Primary distribution system shown above serves floor mounted transformer units at load centers. Conventional secondary system is shown below.





OUT OF THE WAY substation is located on the power house roof, two stories above street level. Novel hoist arrangement facilitates changing transformers.

Roof Substation Saves Space

... Location of
a new transformer substation, with a built-in hoistway, on the
power house roof left the adjacent ground areas free for
building expansion at Colgate's Jersey City plant.

By Robert D. Myers,

Power Engineer
Colgate-Palmolive-Peet Co.
Jersey City, N. J.

WHEN we decided to parallel utility power with our own generating facilities, the problem of where to locate the transformer sub-station arose. Ground locations were ruled out because of possible future plant expansion. Indoor locations were dismissed because of space requirements. We finally decided to spot the transformers on the roof of the power house and run a secondary bus duct connection to the main switchboard on the generator floor.

Roof type transformer substations are frequently frowned upon because of the apparent difficulty in changing transformers if necessary. We overcame this by designing a hoistway as an integral part of the substation structure. It consists of a 12-in. by 31.8 lb. steel I beam, running the length of the substation and extending out over the street, five feet beyond the building line. It is supported by two "A" structures

built of 6-in. by 20 lb. steel H beams. A chain hoist travels the I beam and lifts the transformers over the building parapet. The horizontal braces of the hoistway act as partial supports for the primary and secondary buses.

Primary, three-phase, 4150-volt power emanates from a utility pole across the street, runs underground into the building, goes through a primary oil circuit breaker on the first floor, then continues up to the roof substation. Here, six 333 kva., 4150/480-volt, single-phase, oil cooled distribution transformers are set in two parallel rows on a 16-ft. by 17-ft. concrete mat with a retaining curb. The primaries are star connected through two sets of $\frac{1}{2}$ -in. by 2-in. copper buses mounted on the outer edges of the bus supporting structure. Since there is only one incoming primary line, the two sets of buses are interconnected by a cable and conduit jumper which loops under the secondary buses at the "load" side of the mat.

The transformer secondaries are delta connected through three continuous $\frac{1}{2}$ -in. by 5-in. copper buses which loop the hoist structure horizontally in "U" fashion. Insulated spacers maintain

proper spacings at the radii of the buses. Primary transformer connections are made with flexible cables while the secondaries are tied-in with prefabricated rectangular, removable bus segments.

A 2500-ampere, totally enclosed secondary bus duct connects the substation with the main switchboard buses. This duct, fabricated by the Kolton Electric Mfg. Co., is weatherproofed and consists of two $\frac{1}{2}$ -in. by 4-in. copper buses per phase. The removable cover is U shaped and made of galvanized sheet steel. The duct is supported horizontally by a channel iron trestle to the side of the building where it drops vertically to the first floor level, enters the generator room and terminates in an air cooled circuit breaker which is connected to the switchboard main buses. Expansion is permitted by the use of "spring loaded" bolts to support the duct, and by slotting the holes through which these bolts pass. We thus provide for limited movement of the duct in both longitudinal and vertical directions. A specially designed control panel automatically balances the load between generators and maintains a predetermined load on the utility lines. The substation electrical work was done by A. Neri, Inc., of Hoboken, N. J.

Normally, roof substations are generally out of sight. Hence, some provision must be made to guard against fire. For this protection we use the "Mulsifyre" projectors. This system is made up of 24 specially designed nozzles intended to discharge water in the form of well distributed spray, which strikes with considerable force the surfaces to be protected. This bombardment of the surface of burning oil with the water spray at sufficient velocity forms an oil-in-water emulsion which quickly extinguishes the fire. This system is manually controlled from the generating floor of the power house. Quartzoid thermostats, located over each transformer, actuate an alarm in case of fire. Full automatic control can be added.

Placing transformer substations on roofs is a comparatively new idea. But plants, today, need every available inch of floor space for present or future use. And, placing as much electrical equipment as is practicable out of harms way is an all-important factor. Here is an idea that solved both problems and merits serious consideration whenever additional transformers are needed.

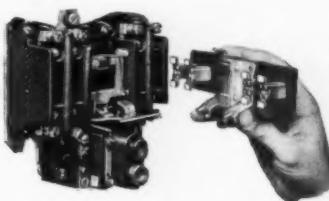


Dust is no respecter of persons or places. It settles on horizontal surfaces everywhere whether these surfaces are tops of officers' caps or parts inside motor control in a factory.



Because dust is so commonplace, it is very easy to underestimate the trouble it can cause in modern electrified manufacturing. And that is too serious to ignore in these days when interruptions to production are not only a hazard to industrial efficiency but to national security as well. This is no time to take chances. Guard your production with dependable Cutler-Hammer Motor Control, the Motor Control that uses dust-safe VERTICAL contacts exclusively . . . the contacts that can't collect dust, that stay clean to work better and last longer. Specify Cutler-Hammer and see the difference. CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee, Wisconsin. Associate: Canadian Cutler-Hammer, Ltd., Toronto.

Cutler-Hammer Vertical Contacts are the mark of better Motor Control, another extra dividend on Cutler-Hammer's unequalled specialized experience and decades of Motor Control leadership.



Dust Safe VERTICAL Contacts

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THREE "EXTRA PROTECTION" FEATURES GIVE EVERY **TRI CLAD
MOTOR GREATER STRENGTH AND LONGER LIFE**

1

*Extra
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protection
against
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**ARMORED CONSTRUCTION . . . SMOOTH CONTOURS . . .
RIGID ALIGNMENT**

Strong, one-piece, cast-iron frame and cast end shields, with upper portion completely enclosed, protect vital motor parts from external blows, falling objects, or dripping liquids. There's less chance of damage in installation, or in operation under "slam-bang" conditions.

"FORMEX" WINDINGS . . . BONDED COIL UNITS

Stator windings of Formex wire give extra protection against moisture oil, abrasion, and heat-shock. New synthetic-resin bonding varnish and Glyptal No. 1201 Red on end-turns add to durability. You can count on uninterrupted performance and long life under strenuous conditions.

**NEW BEARING DESIGN . . . ONE-PIECE, DYNAMICALLY
BALANCED ROTOR**

Sleeve bearings proportioned and grooved for protective lubrication under severe loads. Sleeve and ball bearings enclosed in strong, dust-tight housings. One piece rotor, with fans cast integrally, has new electrical and mechanical features assuring smooth, cool operation and high efficiency.

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

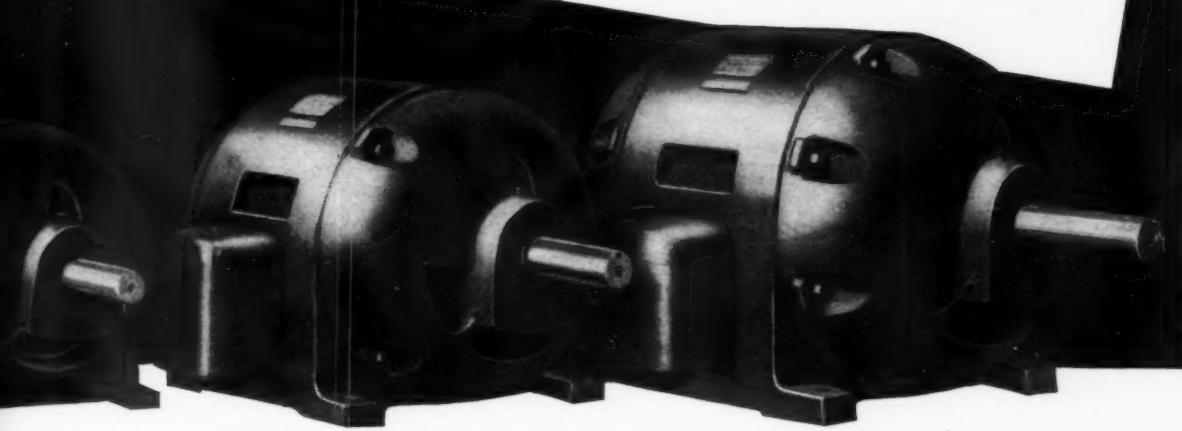
BUILT FOR PROTECTION FIRST . . . TO LAST!

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TRICLAD polyphase induction motors
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75 hp
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30 hp
25 hp
20 hp
15 hp
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5 hp
3 hp
2 hp
1½ hp
1 hp



. . . a **LARGER** range of sizes!
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The advanced design and triple-tough construction that won industry's enthusiastic acceptance almost overnight have now been extended to many larger motors in our a-c line.



General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

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Editorials

A Challenge

The most pitiless scarcity that besets our war effort is TIME. Time to plan, time to build, time to coordinate, time to train, time to get set, every move toward victory takes up more of that precious commodity.

On page 17 is a challenge to the men who create, direct, operate and serve American industry. Read it. Pass it along to your associates. It's important.

To get power to machines, to give light to production, to speed up communications and to keep the wheels moving is our particular job. In this we are one of the vital links in the great industrial machine that we know can outstrip any power or combination of powers, but we need time to direct its energy to war.

We shall be glad to send reprints of Mr. McGraw's editorial to any of our readers who want them.

Blackout

A month ago the emphasis in America was on light—more of it. But since a seven o'clock air raid on Hawaii on the morning of December 7, all along the two coastal regions of the nation, the blackout has taken the place of light. It takes a major adjustment in thinking, in habits, and in technique to swing from one extreme to the other, yet it is being done and by now, efficiently.

Just as the electrical contractors of America installed the lighting which distinguished this country in the world, there is an opportunity for contractors to assist the public in its extremely limited use of light now. This logically is their function in the war adjustment, their contribution to the morale and productivity of the nation.

There are methods of providing light

even in a blackout. It requires well planned screening of windows, doors, skylights. When such openings are screened, it is desirable for the sake of maintained production and for morale to keep the light burning inside. Often this requires special lighting installations. Certainly in defense plants if daylight is to be painted out to insure uninterrupted night production, additional artificial lighting will be necessary.

Alert contractors will obtain the Civilian Defense manual on "Blackout," school themselves in it, make themselves available to their local authorities and serve their nation by rendering expert lighting and blackout service.

Get in the Scrap

Salvage of scrap metal is so important that OPM has undertaken an Industrial Salvage Program. Round up your scrap metals, sell them to your junk dealer and help in this job. Don't underestimate the importance of your scrap pile. It is needed right now.

Battered boxes, junk pipe, wire, machine bases, old motor frames, switchboard parts, rods, bars and bolts are common debris around the shop. They will help to satisfy the war's enormous appetite for metals.

Get in the scrap, your country needs it today.

Cooperation Now

OPM has given the green light to groups of business men who want to pool their efforts to help the Victory program. There is no place in the picture for brokers or price riggers. But

for sincere men who see cooperative ventures as a way to serving Uncle Sam better, or easing the hard lot of the little firms, there is help and counsel now.

Plans must be submitted in advance. The nearest OPM office advises how to make applications and final approval protects the group against violations of the anti-trust laws. It is advisable, however, to check with State authorities where similar state laws are in effect.

Local groups of electrical contractors can now match the construction projects in their own communities with appropriate facilities, skill and manpower through organization. The ruthless process of waiting for the little fellow to go broke, give up his business and go to work for the overloaded big contractor is out. Through organization they can now join forces and keep their trained staffs intact and at top efficiency.

Opportunity Knocks

The FHA's Repair for Defense program is giving a new lease on life to the small electrical contractor who is hit hardest by priorities and the war effort. And it provides an opportunity for him to play a part in the defense of this country.

Defense workers need living quarters. Under this program materials can be secured to convert older houses into light-housekeeping flats and to remodel old dwellings. This means revamping the electrical system, more outlets, more convenient switching and in general, the raising of the wiring standards in thousands of these homes in war industry areas.

The house-wiring contractor would do well to familiarize himself with the FHA program; to survey the possibilities in his local community—then do a job of it.

Trailers and the Code

Every once in a while someone barks at the National Electrical Code or at city ordinances based upon it and opines that if it could be modified—meaning relaxed in its requirements—things would be great for the public.

Not long ago the restricted defense housing limitations were released with some such publicity story.

What such people seem to forget, if they know it at all, is that the Code is not a commercial standard, but one of safety to life and limb. As such it is the bare minimum that experience with electricity has taught the practical code makers is absolutely necessary.

Trailers, bought in large quantity by the government to act as temporary housing for defense workers' families, have given the Code another left handed justification. Even though built by reputable manufacturers eager to turn out a quality product, these trailers had been wired as an automobile is, wires tacked to the frame and concealed between wall panels. But the current carried over these wires is far greater than that needed to light a sedan dome light. Trailers are fed 110-volt supply from a cord to outside plug-in boxes. And when a wire is damaged the frame becomes energized with a voltage that may be lethal.

The manufacturers of these trailers ignored the Code. Actual field tests found a number of them were "hot". Fortunately only a dog was killed before it was discovered. But this example proves the need for safety regulations for the wiring of anything with which people may come in contact.

Cost Plus For Speed

During the last war, cost plus percentage contracts got a bad name because they provided a cash incentive to stall and stretch out jobs. A handful of dollar patriots fouled the nest for thousands of honest and sincere business men then. Now this flexible, speedy and inherently equitable type of contract is looked upon with suspicion and discussed with wholly unnecessary caution.

On electrical projects, particularly industrial change-over jobs, work can be started and well advanced before final plans are complete. The percentage contract permits business negotiations with a bare minimum of preliminary data. Orders can be placed, mechanics scheduled and the job started at once. Overtime and shift schedules can be used generously to get the work done in the shortest possible time.

Under present government regulations, tax laws and price controls, wisely drawn percentage contracts are a sound and practical business device for speeding the war effort. There is no time now to experiment with theoretical profiteer-proof arrangements.

Bonus to Bonds

In many well managed concerns, it is customary to supplement office salaries and the wages of key men with a bonus at the end of profitable years. The 1941 net for some contractors and industrial service shops serving the defense boom was the best in many years and sizable bonus checks are being distributed.

And this year the problem of what to do with the money is answered for all of us in one simple phrase—"Buy Defense Bonds and Stamps."

Doctor Priority

The restrictions already imposed by the priorities program and the more stringent ones that will result from our war effort may pave the way to further standardization and simplification in the electrical wire, device and equipment fields.

Conservation of materials, increased demands and rush construction schedules dictate the focusing of production on standard equipment. Architects, engineers, contractors and management are specifying and ordering standard items. Similar equipment that is "just a bit different" must be forgotten.

Although we may dislike the restrictions we are facing, they may cure the ills of duplication we have been nursing so long. And out of it all may come a sound program of standardization and simplification of electrical equipment.

Lighting Control

Only a short month ago, we looked upon emergency control switching for commercial and industrial lighting rather academically. It was a possible but obviously improbable need. It was

important enough to make rough plans for, but hardly something we could expect our good customers to spend money on.

Now we have a job. Our coastal cities are testing blackout precautions. Washington is deluged with inquiries about what to do. Obscuration is one method, essential in plants where production must go on. But in most buildings it is enough to turn off all lights.

The problem isn't easy. Pulling the main switch would cut off power for pumps and ventilation that may be essential. Dim, shielded pilot lights must be kept on until the building is empty. And main disconnects are not always designed for operation under full load. There is the further problem of restoring light after the "all clear" sounds. To throw a building load of type "C" lamps on the service at one instant could be disastrous.

One solution, already used in London, should prove practical in many of our crowded commercial areas. Individual panel feeders are interrupted by magnetic contactors. The operating coils are energized in sequence, each contactor operating the solenoid in the following contactor. The master light switch controls only the first contactor in the group. Thus the instantaneous current inrush on closing is limited to the connected load on only one panel or feeder, the others following in quick succession.

Identify Your Men

New and strict regulations have been laid down by the FBI for guards and gatekeepers at important factories. Their methods are thorough and necessary. If your mechanics are frequently sent to such plants, help by cooperating with the executives responsible for guarding the property.

Make sure that your men can produce proof of citizenship, birth certificate or citizenship papers. Provide them with identification cards or badges that cannot be duplicated or transferred. Consult the chief of the guard in each plant where your men may be called, and learn the rules.

Rigorous precautions need not be complicated. The test is, could any unauthorized person use your company name or credentials to get into your customer's plants.

WIRING Methods

SMALL WELDS

A compact bench welding transformer is used for many small repair jobs at the Circle L Electric Co., in Tulsa,



HANDY WELDER gives instant heat for small welds, brazing or soldering at the repair bench.

Oklahoma. With a maximum primary drain of 25 amperes, the device is capable of handling welds on light metal, brazing and soldering.

As a time saver for occasional brazing and soldering, it is still well worth the investment, they say, as it is ready to use as soon as the switch is closed. Plugs and taps allow a choice of current capacity and voltage for spot or arc work.

MOBILE WIRE REEL PLATFORM

A portable rolling scaffold with wire reel supports is used by the Hixon Electric Co., electrical contractors and engineers of Boston, Mass., for installing branch circuit wiring in large open area locations.

The scaffold is made of 1½-inch conduit fastened with pipe clamps. It is 10-ft. long, 5-ft. wide and has an adjustable platform. The reel rack, mounted to the scaffold about three feet

above the floor, consists of two ten-foot lengths of wood 2 by 4's, clamped to the pipe uprights and side braces. The rack has five cross bars, each with a capacity of four reels, each containing 4,000 feet of either No. 14 or No. 12 wire. Wood cross pieces above the reels have slots for guiding the wire. The working platform above has similar openings.

A two-man crew works with the scaffold. After threading the required number of wires through the guide bars and platform, one mechanic remains on the scaffold paying out the wire while a second one, working on a plank extension to an "A" ladder, pushes the wires through the conduit from outlet to outlet. When ready to move on, the ladder and plank are advanced and the scaffold pushed up to the next location.

In the accompanying photograph, the rack contains eight reels of different colored No. 14 wire and one reel of No. 14, 4-wire conductor for the home-runs from the lighting network system.

ROLLING SHOP

In place of the familiar piano box tool shed, the Harlan Electric Co. of Detroit has standardized on a portable machine shop and work bench for on-the-job use.

The bench is six by three feet rolling on heavy rubber tired casters. Space below is accessible through a removable



ROLLING MACHINE shops gives power operation to tough and time consuming operations on the job as well as replacing the piano-box tool storage

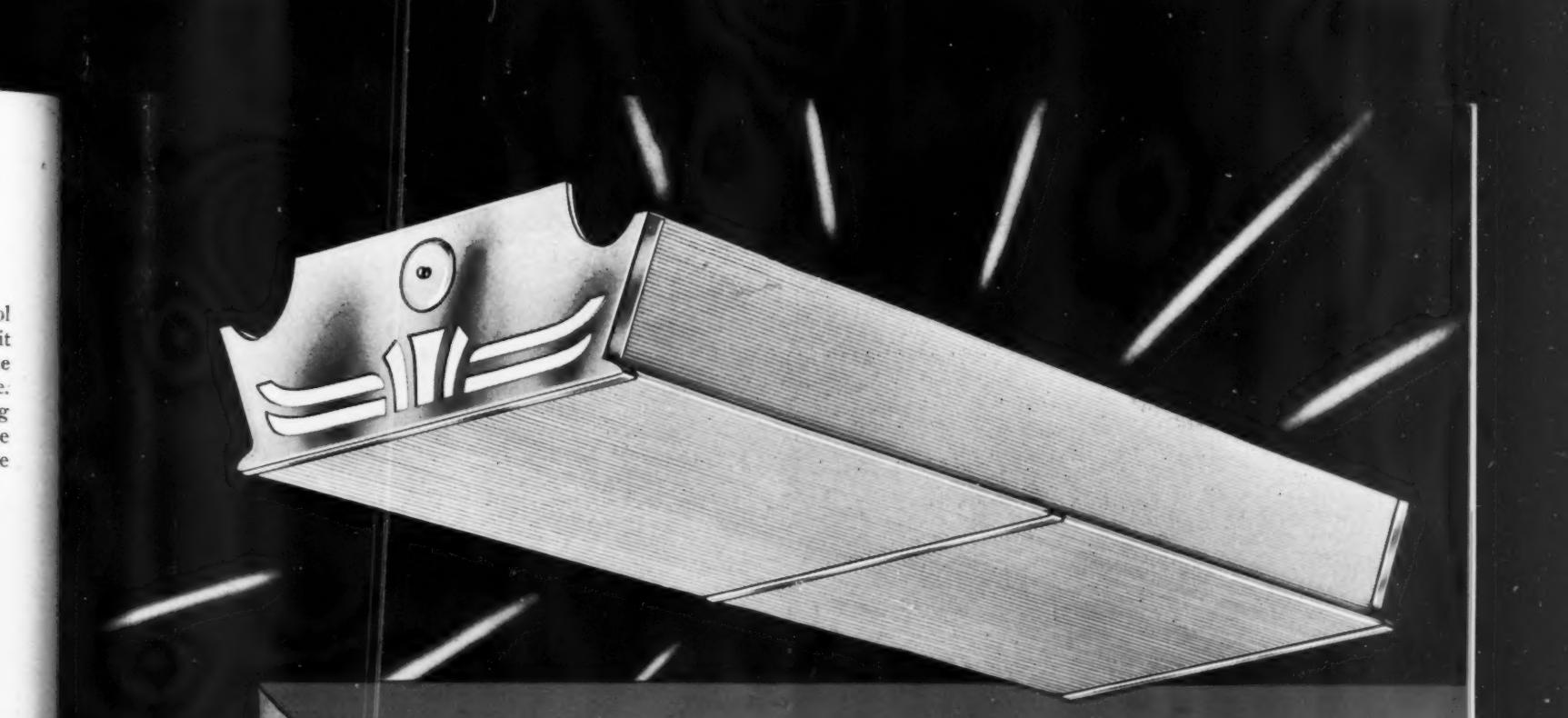
panel which provides a storage bin for mechanics' tool bags and may be securely locked.

Mounted on the bench are, (1) a power drill press with a ½-inch chuck which may be swung out to use hole saws on cabinets or boxes, (2) a power drive for cutting and threading conduit up to 2 inches, (3) a standard pipe vise and (4) a husky machinist's vise and anvil.

Ratchet type, one handle, stocks are used with the power drive. For larger pipe sizes a shaft with universal joints



REEL SCAFFOLD speeds up wire pulling in buildings with large open floor areas. This one can hold twenty reels of different colored building wire.



ANNOUNCING

the Revolutionary Mitchell
U.R.C. RESEARCH Luminaire

THE MOST SIGNIFICANT MAJOR DEVELOPMENT
IN THE ANNALS OF FLUORESCENT LIGHTING!



CEILING MOUNT

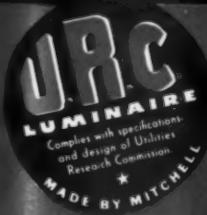
PENDANT MOUNT

CONTINUOUS ROW

3 TYPES OF INSTALLATIONS WITH 1 MODEL

TWO YEARS OF INTENSIVE RESEARCH

by the Utilities Research Commission now brings you an utterly NEW, LOW-COST SHIELDED FLUORESCENT FIXTURE offering greater all-around lighting benefits than any fixture previously conceived . . . the new U.R.C. RESEARCH LUMINAIRE! Read the amazing story of this history-making lighting development on the inside pages!



ELECTRICAL
CONTRACTORS!

^{NEW}
U.R.C. IS THE FLUORESCENT—
“Made to Order” FOR CONTRACTORS!

U.R.C. IS UTILITY-DESIGNED AND BACKED
U.R.C. IS “BETTER LIGHT, BETTER SIGHT” FLUORESCENT
U.R.C. WINS INSTANT CUSTOMER ACCEPTANCE
U.R.C. IS EASIEST YET TO INSTALL, MAINTAIN
U.R.C. IS UNBELIEVABLY LOW PRICED!

IT WILL PAY YOU TO READ EVERY WORD ON THESE PAGES!

UTILITIES RESEARCH COMMISSION *Designed IT!* MITCHELL *Manufactures IT!*

What Is the U.R.C. Research Luminaire? It is an utterly NEW shielded 200-watt 4-Light Fluorescent Fixture that provides lighting vastly superior to that of any previous fixture . . . the result of over two years of scientific research and development.

Who Developed It? A committee of outstanding lighting engineers appointed by the Utilities Research Commission.

Why Was It Developed? Bare lamp fixtures and the majority of “shielded” fixtures are objectionable for many lighting applications. Serious need long has been felt for a Fluorescent unit that would meet all Better Light, Better Sight requirements, obtainable at no greater cost than ordinary fixtures. The new U.R.C. Research Luminaire fills those needs more completely than any fixture yet developed for commercial lighting application.

What Are the Advantages of the U.R.C. Over Other Fixtures? The 8 important features listed below are not claims, but facts, based on the findings of the Utilities Research Commission lighting engineers, whose work is independent of all lighting manufacturers. Compare these features with those of any existing fixture!

1. Extremely Flexible. Three major types of lighting installations can be made with one model: (1) Individual ceiling mounting; (2) Individual pendant mounting; and (3) Continuous row mounting. This eliminates the need for special ordering from factory, because the one model only need be stocked, with quick service and installation assured. (See chart 2 on opposite page.)

2. Higher Lighting Efficiency! With the U.R.C. Luminaire it is possible to build up higher illumination values . . . from 50 to 100 footcandles! . . . (See charts 6 and 8 on opposite page.)

3. Low Brightness. The higher lighting intensities provided are achieved with a lower surface brightness than ever before attainable. The average conventional shielded fixture today has brightness as high as 3 and 4 candlepower per square inch. Bare lamp fixtures even higher. At all normal viewing angles, the U.R.C. brightness does not exceed 0.9 candlepower per square inch!

4. Easy and Quick Installation. U.R.C. features an entirely new method of installation which makes the hanging of a fixture a matter of minutes. Metal tracks, fastened to the ceiling by toggle bolts or Ackerman, are lined up four feet apart. The fixture section simply “slides into place” on the tracks. Repeated time checks reveal that U.R.C. Luminaire can be installed in one-half to one-third the time of ordinary fixtures. (See charts 3 and 4 on opposite page.)

5. Easier to Relamp and Maintain. Relamping is quickly accomplished by removing bottom glass panels. Side panels need not be removed. Starters can be removed without disturbing lamps. No tools required to remove glass panels for cleaning. Any unit in a continuous row may be disconnected completely and easily at any time. (See chart 5 on opposite page.)

6. Design Is Modern and Functional—pleasant to the eye—suitable for office, store or any other commercial installation.

7. Meets All Better Light, Better Sight Requirements.

8. Unbelievably Low Price! Despite the fact that it represents a completely new concept of Fluorescent Lighting, with demonstrably superior features throughout, the Mitchell U.R.C. Research Luminaire costs no more than the average, ordinary 4-light fixture! The U.R.C. has a list price of only \$39.95 complete, less bulbs. (When Pendant Mounting type is desired the Stem Suspension Set, consisting of two stems with canopy and strap, is available at a list price of \$1.75.)

MODEL NO. 2032 MITCHELL U.R.C. Research Luminaire	List Price \$39.95 Less Bulbs
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(West and South \$43.95)

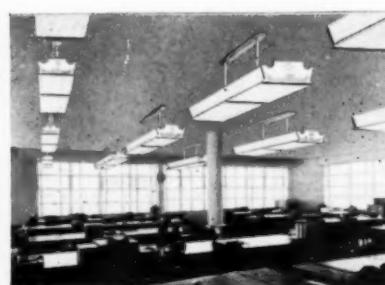
No. 032 ST Stem Suspension Set for above \$1.75



INDIVIDUAL CEILING MOUNTED



SINGLE CONTINUOUS ROW



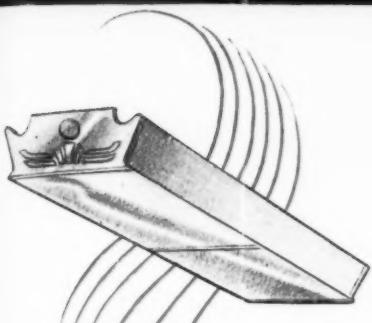
INDIVIDUAL PENDANT MOUNTED



CONTINUOUS ROWS

A RADICALLY NEW AND BETTER FORM OF LIGHTING

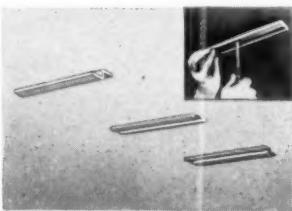
JUST CHECK THESE OUTSTANDING ADVANTAGES AND COMPARE WITH ANY OTHER FIXTURE!



A *Beautiful* PACKAGE OF
PERFECTED FLUORESCENT LIGHT
FOR ANY COMMERCIAL USE

1

TWO TYPES OF TRACKS FOR CONTINUOUS ROW AND CEILING MOUNTING



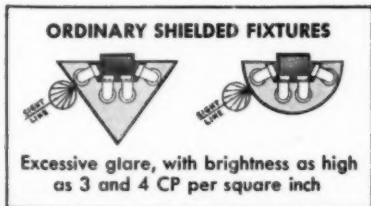
Single track used when units are mounted individually



Double track used where units join for end-to-end mounting

4

LOW BRIGHTNESS!



Excessive glare, with brightness as high as 3 and 4 CP per square inch



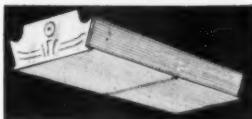
Brightness does not exceed 0.9 CP per square inch

7

3 APPLICATIONS WITH ONE MODEL!



1. For Pendant Mounting



2. For Individual Ceiling Mounting



2. For Continuous Row Mounting

3

EASY TO INSTALL!



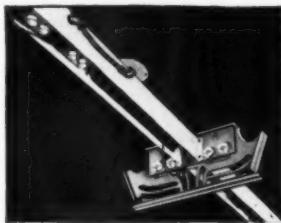
Just Slide on to Tracks



A matter of minutes to fasten each track to ceiling, slide and lock fixture in place, splice to outlet and insert glass... requires less time and effort to install than any other fixture

3

EASY TO MAINTAIN!

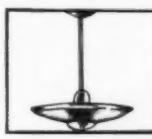


1. Glass panels easily removable for relamping and cleaning
2. Starters replaceable without disturbing lamps
3. Wiring channel accessible... just remove 2 wing nuts

5

HIGHER LIGHT INTENSITIES!

Compared with Incandescent



4 Ft. Candles
Per Watt
Per Sq. Ft.



7½ Ft. Candles
Per Watt
Per Sq. Ft.



U. R. C.
FLUORESCENT 16 fc. Per Watt
Fixture

6

UNBELIEVABLY LOW PRICE!



Ordinary 4-Lite Exposed
Tube Fixture Average List, \$38.00



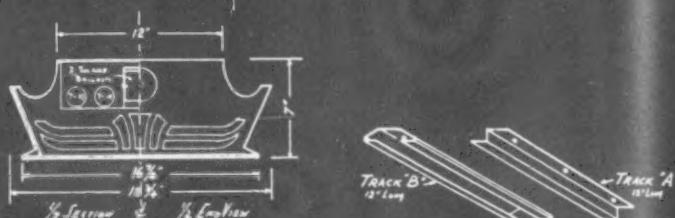
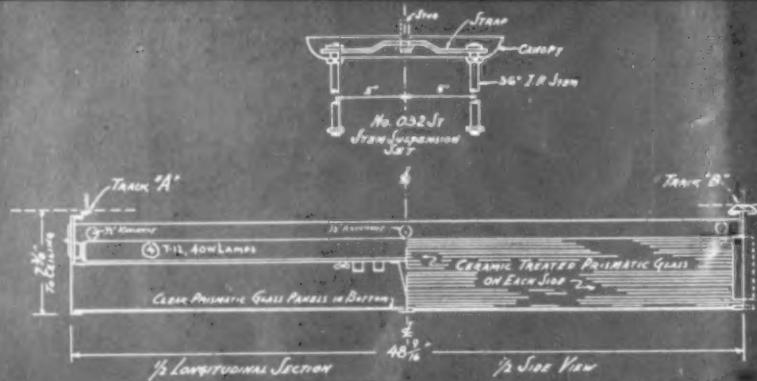
U. R. C. FIXTURE
LISTS AT \$39.95
ONLY...

9

FOR OFFICES, STORES AND OTHER COMMERCIAL APPLICATIONS

INSTALLATION AND LIGHTING DATA

Mitchell U.R.C. RESEARCH Luminaire



SPECIFICATIONS—MODEL NO. 2032

This fixture is designed for mounting directly to the surface of the ceiling, either as an individual unit or end-to-end to form a continuous row. Also it can be used for pendant hanging, with Model 032-ST Stem Suspension Set, which consists of two 36" stems, canopy and strap Unit utilizes four 40 watt, T-12 48" fluorescent lamps. Dimensions: 48 $\frac{3}{4}$ " long, 19 $\frac{3}{4}$ " wide, 7" high.

CHASSIS: Constructed from a single sheet of steel with trunk cover of No. 18 U.S.S.G (.050") secured to body with two wing nuts. Two knockouts provided on the top for mounting of stems if fixture is used for pendant hanging. $\frac{1}{2}$ " knockouts in center of the sides, and 1 $\frac{1}{2}$ " from each end for connection to ceiling outlet. Surface is high reflecting, non-chipping white enamel throughout.

END PLATES: 20 gauge steel (.0375") and finished in Satin Aluminum. Knockout provided for $\frac{3}{8}$ " nipple and lock-nut, which serves to lock fixture sections together and provide raceway for feeds from one unit to another.

TRACK MOUNTING: Mounting to surface of ceiling is made by means of track sections "A" and "B," made of No. 18 U.S.S.G. steel. Track "A" is single type used on ends of continuous rows, or when single unit is surface ceiling mounted. Track "B" is double type used when two units are joined

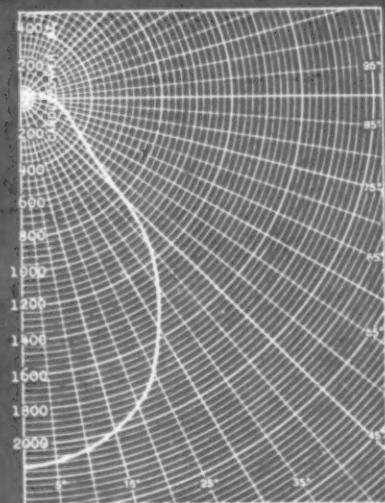
together end to end. Packed as standard equipment with each fixture are two type "A" tracks and one type "B" track.

DIFFUSING PANELS: Side panels consist of double strength ribbed ceramic-coated glass. When fixture is lighted, glass is uniform throughout, and has a transmission factor of approximately 35%. Edges are ground smooth. The bottom panels are double-strength prismatic ribbed glass with transmission of not less than 85%. Edges ground smooth.

BALLASTS, STARTERS, ETC.: Latest, approved Tulamp Ballasts. Starter switches latest, standard type, located so they may be replaced without disturbing lamps. Unit bears Underwriters' Laboratories and U.R.C. Certification Labels. Unit operates on 110-125 volts, 60 cycles, Alternating Current. (Available for 50 cycle on special order, \$5.50 extra) Shipping weight 55 lbs., packed one unit to a carton.

List Price: Model No. 2032 MITCHELL U. R. C.
Luminaire.....\$39.95

List Price: No. 032-ST Stem Suspension Set for
above, consisting of 2-36" stems, canopy & strap \$1.75



LUMINAIRE DISTRIBUTION DATA					
MID-ZONE ANGLES	APP. C. P.	ZONAL LUMENS	MID-ZONE ANGLES	APP. C. P.	ZONAL LUMENS
180°			90°		
175°			85°	215	235
165°			75°	226	239
155°			65°	328	328
145°			55°	438	392
135°	6	5	45°	854	661
125°	22	20	35°	1320	829
115°	52	51	25°	1762	816
105°	134	142	15°	1984	561
95°	159	173	5°	2097	200
			0°		



DESIGNED BY
UTILITIES RESEARCH COMMISSION

Bulletin No. 267. Printed in U. S. A.
Copyright 1941 by Mitchell Mfg. Co.

Manufactured by..



connects the power drive with geared stocks and dies.

A duplex plug receptacle on the side of the bench provides for extension lighting and portable power tools.

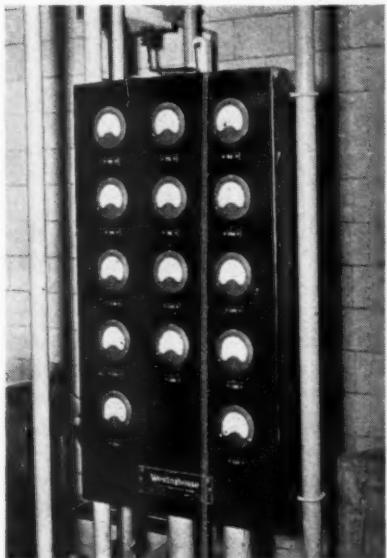
The rolling shop has practically eliminated hand pipe work, even on small jobs. For industrial work the bench is equipped with an arc welder operating on 220 volts single phase. Several identical rolling shops are used on larger construction projects and industrial modernization, each located near a center of operation.

ELAPSED TIME INDICATOR PANEL

One problem the maintenance men at the Washington National Airport will not have to worry about, is that of lamp burn-outs in the field lighting circuits.

Its all due to the elapsed time indicator panel which the H. P. Foley Company, electrical contractors of Washington, D. C., installed in the electrical equipment room of the airport terminal building. This panel ties in with the floodlight, runway contact and boundary light circuits.

The panel, which is supported by U-bolts to two conduit uprights, contains fourteen electrically operated elapsed time indicators which look very much like ordinary watthour meter dials. These indicators are connected in the control circuits of the lights mentioned



PROTECTION AGAINST unheralded lamp burnout in field lighting circuits at the new National Airport at Washington is provided by this elapsed time indicator panel.

BURNDY SCRULUG

INSTALLED
WITH
SCREWDRIVER,
WRENCH
OR PLIERS

No special tools required for rapid, safe connection of this high strength, low cost terminal connector!

BURNDY • 107 EASTERN BLVD • NEW YORK, N. Y.

FOR EVERY INDUSTRIAL, COMMERCIAL
OR RESIDENTIAL REQUIREMENT...

Sell the time-saving line...

LATROBE

FLOOR BOXES and WIRING SPECIALTIES

NO. 330 "LATROBE" TOM THUMB UTILITY OUTLET



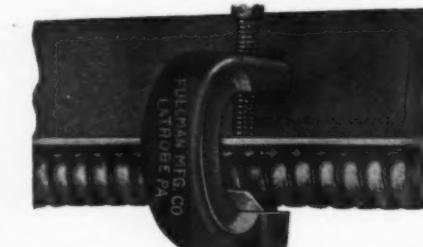
To be used in wood installations and other locations free from moisture or mechanical injury.

NO. 285 DOUBLE DUPLEX RECEPTACLE NOZZLE



An attractive unit, easy to install. Shown here with No. 200 Cover Plate.

NO. 480 "BULLDOG" ARMORED CABLE SUPPORT



Light weight and strong, for supporting or hanging cable from any angle. Easiest, most economical method of temporarily or permanently installing armored cable.

NO. 130 ADJUSTABLE WATER TIGHT FLOOR BOX



No. 130 Box with No. 207 Bell Nozzle. Cut-away view illustrates how tapered unit receptacle fits tapered opening in adjustable ring. Cover plate 3 1/2" — overall height 3 1/2".

To meet the expanding requirements of your buyers, sell the LATROBE LINE...it's complete in every detail, including floor boxes and wiring specialties adapted to commercial, industrial and residential jobs.

Aside from the fact that the LATROBE LINE is complete as to products, there are many other features that make their sale easier. First among these is the time-saving element. Each LATROBE item has been designed to decrease installation time...an important point to stress to contractors. Then, too, each LATROBE Floor Box or Wiring Specialty is flexible as to use...safe and long-lived in operation, and made of the best materials available.

So, stock the line that saves time...sell LATROBE wherever quality, usability and economy are the desired features. Write for our price and product list today...also a copy of our distributor plan.



Write for details TODAY!

FULLMAN MANUFACTURING COMPANY
LATROBE • • • • PENNSYLVANIA

WIRING Methods

[FROM PAGE 39]

above and enable the maintenance crew to read how many hours the lamps on each circuit have been burning. Thus, as the rated life of the lamps is approached, they can be replaced before actual burnouts occur.

POWER FACTOR CALCULATION

A power factor chart, for use in determining power factor by the two wattmeter method has been developed by Frank Collins of Charlestown, West Virginia. The points on the chart were derived by solving the familiar tangent formula given below:

$$\begin{aligned}\text{Tangent } \theta &= \sqrt{3} \left(\frac{W_1 - W_2}{W_1 + W_2} \right) \\ &= 1.732 \left(\frac{W_1 - W_2}{W_1 + W_2} \right)\end{aligned}$$

Where:

W_1 = high wattmeter reading

W_2 = low wattmeter reading

θ = electrical degrees of phase displacement.

Knowing the value of tangent θ , the value of the angle θ can be determined from the tangent tables. Knowing θ , the cosine θ can be taken from the cosine tables and hence the power factor will be known for:

Power Factor = Cosine θ

Instead of going through these calculations each time a reading is taken, Mr. Collins made his series of calculations for various readings and plotted them in a chart form. The chart covers the range from approximately 50 to 100 per cent power factor.

When taking readings with a polyphase wattmeter, one lead on one potential coil is lifted and a reading taken. This lead is replaced and one lead from the other potential coil is lifted and another reading taken. These two readings W_1 , W_2 are slotted at the bottom and side of the chart, W_2 being the lower reading. From these readings the power factor can be read directly from the chart.

If the line voltage is known and an ammeter is inserted in series with one current coil of the wattmeter, the wattmeter reading can be checked by using the following formula:

$$\text{Watts} = \sqrt{3} \times E \times I = P.F.$$

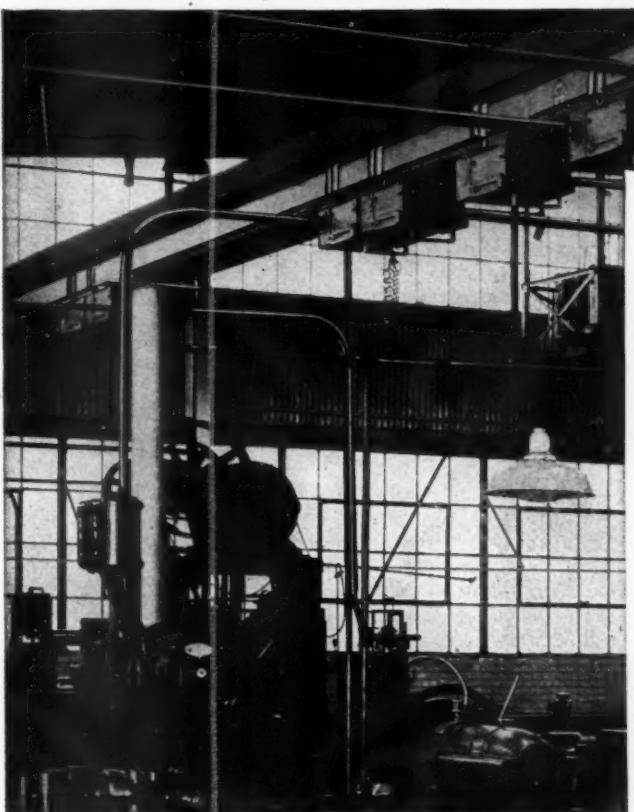
The above, of course, refers to three phase systems with balanced loads and assumes that the power does not change between the time that the two single phase wattmeter readings are taken.

Electrical Contracting, January 1942

You, too, can



+ ADD
- SUBTRACT
X MULTIPLY
÷ DIVIDE ...



Typical FLEX-A-POWER installation showing how connections to load are made with FLEX-A-PLUGS.

... if your plant is equipped with
TRUMBULL FEEDER DISTRIBUTION SYSTEMS

You can ADD new machines as production demands increase, simply by "plugging in" to FLEX-A-POWER ... "A panel-board running the length of the plant".

You can SUBTRACT machines from one department and add them to another without an hour's loss of time on electrical "hook-ups".

You can MULTIPLY the capacity of your electric power distribution system by quickly installing the new L.V.D. (Low Voltage Drop) BUSS-WA ... "a switchboard running the length of the plant" ... for main power supply with minimum power loss.

And when you may have to DIVIDE your facilities with the resumption of normal civilian production, your investment will be protected because both of these Trumbull Systems are completely SALVABLE.



That's worth remembering in conjunction with the fact that Trumbull FLEX-A-PLUGS (in five types) are specially designed for use with FLEX-A-POWER, and combine the functions of industrial motor circuit disconnects with a simple plug-in method of connecting machine loads to the system.

The importance of superior mechanical and electrical efficiency at these points cannot be over emphasized. It is largely due to the unfailingly dependable performance of FLEX-A-PLUGS that Trumbull Feeder Distribution Systems have been selected for so many important war industries. All Trumbull FLEX-A-PLUGS meet heavy duty industrial specifications.

Get all the facts and figures from latest TRUMBULL-AID Circulars 328 and 335 and Bulletin 408. Write us or call your nearest Trumbull office.

THE **TRUMBULL**
ELECTRIC MANUFACTURING COMPANY
PLAINVILLE, CONN.



OTHER FACTORIES: NORWOOD (CINN.) O. - SEATTLE - SAN FRANCISCO - LOS ANGELES - TRENTON, N. J. (PORCELAIN),

Motor Shops

STATOR STRIPPER

A stator stripping machine using the winch principle has been built in the motor repair department of the John R. Lange Electric Company of Baltimore, Maryland.

The machine consists essentially of an extension to an existing metal bench, with a lever arm arrangement at the end to grip and pull out the coils. The



PULLING COILS from old stators is easily and efficiently accomplished by the use of this stator stripper attached to the end of work bench.

pulling mechanism consists of a short piece of 4-inch pipe with blank pipe caps on each end. A number of holes are drilled around the circumference of one end of the pipe to accommodate a steel pin which acts as the lever arm.

The pipe is mounted by a long bolt to two angle iron extensions at the end of the table. These, in turn, are supported by two angle iron legs fastened to the floor of the shop. A V-shaped piece of channel iron, bolted to the edge of the table top, acts as a stop bar. The actual pulling is done by a chain wound around and fastened to the pipe. The

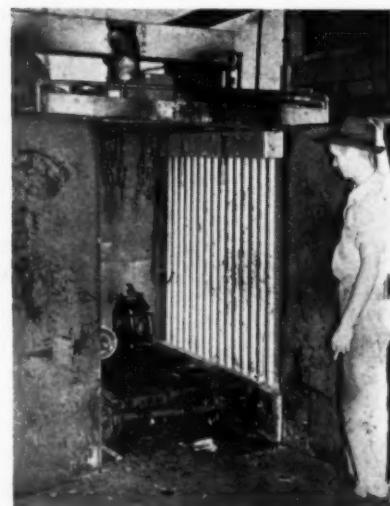
free end of the chain is clamped or hooked to the coils to be removed.

After one side of the coils have been cut, the stator is set on the table with the uncut side facing the stop bar. After the chain has been fastened to the coil, a pressure on the lever arm of the pipe mechanism pulls the coil from the stator slots. This device has proved to be a helpful time saver in the stripping department of this shop.

INSULATED OVEN

Efficient insulation of the walls and doors of the baking oven used at the Smith Milligan Electric Co. in Tulsa, Oklahoma results in considerable fuel saving, steady temperature levels and a more comfortable shop in hot summer months.

The oven, designed and built in the shop, employs three inches of mineral wool insulation in a sealed dead air



WALL INSULATION and efficient radiators maintain even temperature with low fuel consumption.

space between sheet metal walls completely surrounding the oven. Double doors, tightly fitted, are also insulated.

The gas burners operate in enclosures at both sides of the oven. Separate air

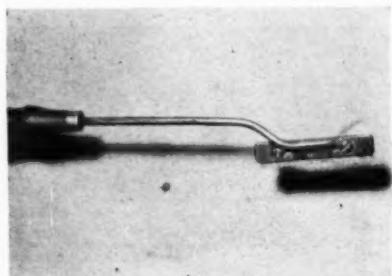
intakes provide air for combustion. Hot gases of combustion rise in vertical radiator pipes, 15 on each side, to flue chambers at the top.

Ventilating air enters through pipes at the bottom which pass over the gas flame preheating the incoming air. A thermostatic gas valve maintains accurate oven temperature.

SLOTTING TOOL

The Central Electric Company, motor repair shop of Bridgeport, Ohio, have made themselves a handy little tool to clean out the mica slots between commutator bars. It is used only where undercutting isn't necessary.

The tool consists of two short pieces



CLEANING MICA between commutator bars is facilitated by the use of this simple tool. It does not replace undercutting, but is used for cleaning.

of flat iron, $2\frac{1}{4}$ inches long, which grip a short piece of hacksaw blade. The blade is held tightly by two screws, with either the head or nut welded to one piece of the iron leaving the other free to tighten or release. An offset handle is welded to this blade holder to provide a secure grip on the tool.

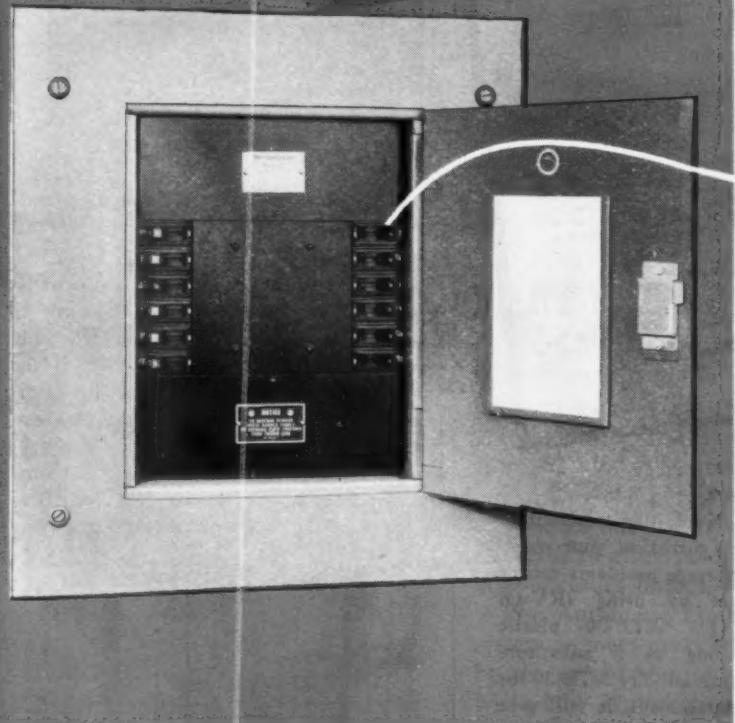
ROTARY SHOP HOIST

To expedite the handling of heavy equipment and reduce the danger of accidents resulting in painful injuries, the J & H Electric Co., Providence, R. I., designed and installed a rotary electric hoist in the winding department of its motor repair shop. It is so located that it can pick up armatures, stators and other work on the hand trucks coming up from the stripping department and swing them over to the winding tables on the opposite side of the area. When the equipment is completely rewound, the hoist is used to return it to the empty trucks to go down to the dipping and baking department.

The rotary mechanism consists of a 7-ft. diameter steel band, $5\frac{1}{2}$ -inches high

**REQUESTED
BY INDUSTRY**

Westinghouse announces...
the **QUICKLAG "De-ion" Circuit Breaker**
Panelboard



Type NLAB Quicklag Panelboards are available in 15, 20, 25 and 35-ampere branch circuit breaker ratings.

Thermal (bi-metal)-magnetic co-operative trip action results in:

- Full-time-Delay Action on harmless overloads
- Fast Tripping Action on short circuits

Quicklag — a quick-make, quick-break, fast-trip action, "De-ion" circuit breaker panelboard for lighting and appliance circuit protection—answering industry's needs for fast tripping action on short circuits and advantageous time delay on temporary overloads.

Ideal for lighting and appliance circuit protection, Quicklag panelboards are being announced at a time when circuit breaker protection is proving its value to high-speed production . . . saving hundreds of thousands of production hours annually. For sale by over 100 Westinghouse Agents everywhere.

J-60492



Westinghouse NO FUZE CIRCUIT PROTECTION

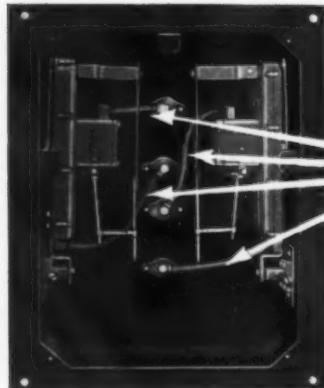


USES CORROSION PROOF IRV-O-LITE PLASTIC TUBING ON THEIR "D" GAGES

The sharp teeth of corrosion were biting into metal connecting tubing on Hays Differential "D" Gages. Read how this problem was perfectly solved with IRV-O-LITE XTE-30 extruded plastic tubing.



Here's what corrosion did to the metal connection on a Hays "D" Gage.



Now the "D" Gages connections are fully protected against corrosion by IRV-O-LITE XTE-30.

equally fine results and performance—may do an even better job as in the case of The Hays Corporation.

Also for electrical insulation, IRV-O-LITE XTE-30 extruded plastic tubing has high dielectric and mechanical strength, exceptional resistance to tearing, abrasion, heat, fire and solvents. Its extreme flexibility and smooth inside surfaces enables quick assembly on wires.

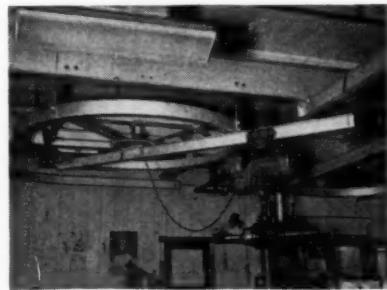
*Test IRV-O-LITE XTE-30 yourself. We'll send you samples.
Write Dept. 96.*

Irvington VARNISH & INSULATOR CO.
IRVINGTON, NEW JERSEY, U. S. A. 
PLANTS AT IRVINGTON, N. J. AND HAMILTON, ONT., CAN.
Representatives in 20 Principal Cities

Motor Shops

[FROM PAGE 42]

and a 7-ft. diameter steel ring, 4½-inches wide, welded together to form an angle iron circular support for the swinging hoist arm. This ring is mounted to the ceiling steel beams by a heavy channel iron framework. The hoist arm is 10-ft. long and is supported at the hoist end by two heavy caster wheels which ride on the inside of the angle iron ring. The two wheels which support the opposite end of the arm ride on the under side of the ring. An intermediate support at the center of



REVOLVING HOIST arm on a circular track simplifies handling of heavy equipment in the winding, dipping and baking departments of this Providence, R. I. motor repair shop.

the ring contains collector rings which feed the ½-ton electric hoist through a heavy duty rubber cord with sufficient slack to permit the hoist to travel from this center point to the end of the arm.

A similar type of hoist, with a smaller diameter ring and shorter swinging arm, is used to move equipment from the dipping tanks to the baking oven in the dipping and baking departments.



AMPLE LIGHT both natural and artificial, good ventilation and clean surroundings, improves efficiency and workmanship in the winding room of the Electric Motor Repair Company of Springfield, Mass. Other departments have similar conditions.



Idealphones—Wall type with molded bandsets. Offered with one or five buttons for common talking service up to ten stations.



Intercoms—Supplied in both desk and wall styles, with molded plastic bandsets. Common talking systems of two to eleven stations.



P-A-X's—Automatic interior telephone systems. Provide dial service and secret connections for from ten stations up. Telephones in a variety of types.

THREE DOORS TO Extra Profit!

• Interested in making a worthwhile addition to your profits? Then find out what money-making opportunities Automatic Electric intercommunicating systems offer you! Many of your *present* customers need private telephones now. And the market is growing—the demand is increasing!

This extra business means more dollars for you not only from the sale of telephones but also from the labor and wiring materials you supply, and from the leads to other prospects you'll get from satisfied customers. The market is big—includes homes, shops, schools, small factories, stores, hospitals, etc.

The Automatic Electric line is complete. There is an intercommunicating system to meet every need. You can depend on their quality—they are made by the originators of the automatic telephone and are backed by Automatic Electric's 50 years of telephone manufacturing experience!

Ask your electrical wholesaler to help you get into this profitable business today. If he cannot give you the information you need, write us direct!

These systems are designed for private service. They are not intended to be connected with the public telephone system.



Your wholesaler should have the Idealfone in this display. See how simple and neat the Idealfone is—how easy to install.

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PRIVATE INTERIOR TELEPHONE SYSTEMS

Distributed by: AMERICAN AUTOMATIC ELECTRIC SALES COMPANY, 1033 West Van Buren Street, Chicago, Illinois
Sales and Service Offices in Principal Cities • In Canada: Canadian Telephones & Supplies Limited, Toronto

FOR EVERY BENDING JOB there's a **GREENLEE BENDER**



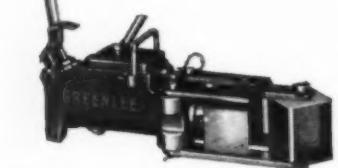
No. 770
Rigid Conduit and
Pipe Bender



No. 770-T
Thin-Wall
Conduit Bender



No. 770-BB
Hydraulic
Bus-Bar Bender



No. 760
Copper Tube Bender



No. 763
Steel Tube Bender

SEND FOR
FREE COPY OF
GREENLEE
BENDER
BOOKLET
S-116

FOR FAST, EASY BENDING OF RIGID CONDUIT

Here's the Greenlee No. 770 Hydraulic Bender for fast, easy bending of $1\frac{1}{4}$ to 3-inch rigid conduit and pipe. This powerful bender, with 25 tons of hydraulic power, will make smooth, accurate bends in $1\frac{1}{4}$, $1\frac{1}{2}$, 2, $2\frac{1}{2}$, and 3-inch conduit or pipe without the use of heat or filler. Sturdily and compactly built into one unit, this bender is easily carried to the job and set up, will not move and twist about when in use, and is easily operated by one man. And for the larger size conduit there's the Greenlee No. 775 Bender with 40 tons of hydraulic power for easy bending of 3, $3\frac{1}{4}$, 4, and $4\frac{1}{2}$ -inch material. Attachments available for these benders increase the range to include most types of conduit bending required in electrical maintenance and construction work.

FOR $1\frac{1}{4}$ " TO 2" THIN-WALL CONDUIT

The No. 770-T Hydraulic Bender for bending thin-wall electric metallic tubing consists of the Greenlee No. 770 Power Unit with special attachments designed to make a full 90-degree bend quickly with one forward movement of the ram. To prevent crushing and kinking, the conduit is supported by a formed follow bar which moves with the conduit during the bending operation. The regular attachments for this machine, which will bend $1\frac{1}{4}$, $1\frac{1}{2}$, and 2-inch thin-wall conduit, can easily and quickly be applied to the No. 770 Power Unit.

BENDS BUS-BAR UP TO 4" WIDE, $\frac{3}{4}$ " THICK

The Greenlee Hydraulic Bus-Bar Bender has been designed to make regular U-bends, 90° bends, or offsets in any size bar up to 4-inches wide and $\frac{3}{4}$ -inch thick. The bus-bar bending attachment has been made to fit the Greenlee No. 770 Power Unit, and can be purchased as a separate attachment or as a complete bender with power unit and attachment together.

FOR $\frac{3}{8}$ " TO $1\frac{1}{4}$ " COPPER TUBING

Greenlee Copper Tube Benders were designed for bending the copper and aluminum tubing used in the plumbing, refrigeration, aviation, and air-conditioning fields. The No. 760 Bender will bend $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, and $\frac{3}{4}$ -inch O. D. tubing while the No. 762 Bender will handle $\frac{3}{8}$, $\frac{5}{8}$, 1, and $1\frac{1}{2}$ -inch O. D. tubing. Ample leverage is provided for fast, easy bending, and a roller holds the follow bar tight to prevent kinking and distortion of the tube.

SIX SIZES OF BENDERS FOR $\frac{1}{4}$ " TO $\frac{3}{4}$ " TUBING

Here's the handy Greenlee No. 763 Steel Tube Bender for bending steel, copper, brass, and aluminum tubing without kinking and flattening of the tube. Six sizes of benders are available for $\frac{3}{16}$, $\frac{1}{4}$, $\frac{5}{16}$, $\frac{3}{8}$, $\frac{1}{2}$, and $\frac{3}{4}$ -inch O. D. tubing. The tube is held tight to prevent slipping, and the bending is done by rolling action, rather than sliding, which minimizes friction, giving a smooth, even bend without marring the finish of the tube.

Greenlee
TOOL CO.
1741 COLUMBIA AVE., ROCKFORD, ILL.

ARMATURE WINDER

An armature holder which can be rotated on a supporting shaft, perpendicular to the armature shaft, is a convenient bench assembly used by the Western Electric Machinery Company of Wichita, Kan.

The device consists of a bench stand in the form of a T with a rotating



ARMATURE CLAMP rotates on horizontal spindle. Wire is guided from floor reel through tubing in foreground.

member carrying two adjustable holders which clamp the ends of the armature shaft. It handles any size shaft up to 30 inches long and a maximum armature diameter of 10 inches.

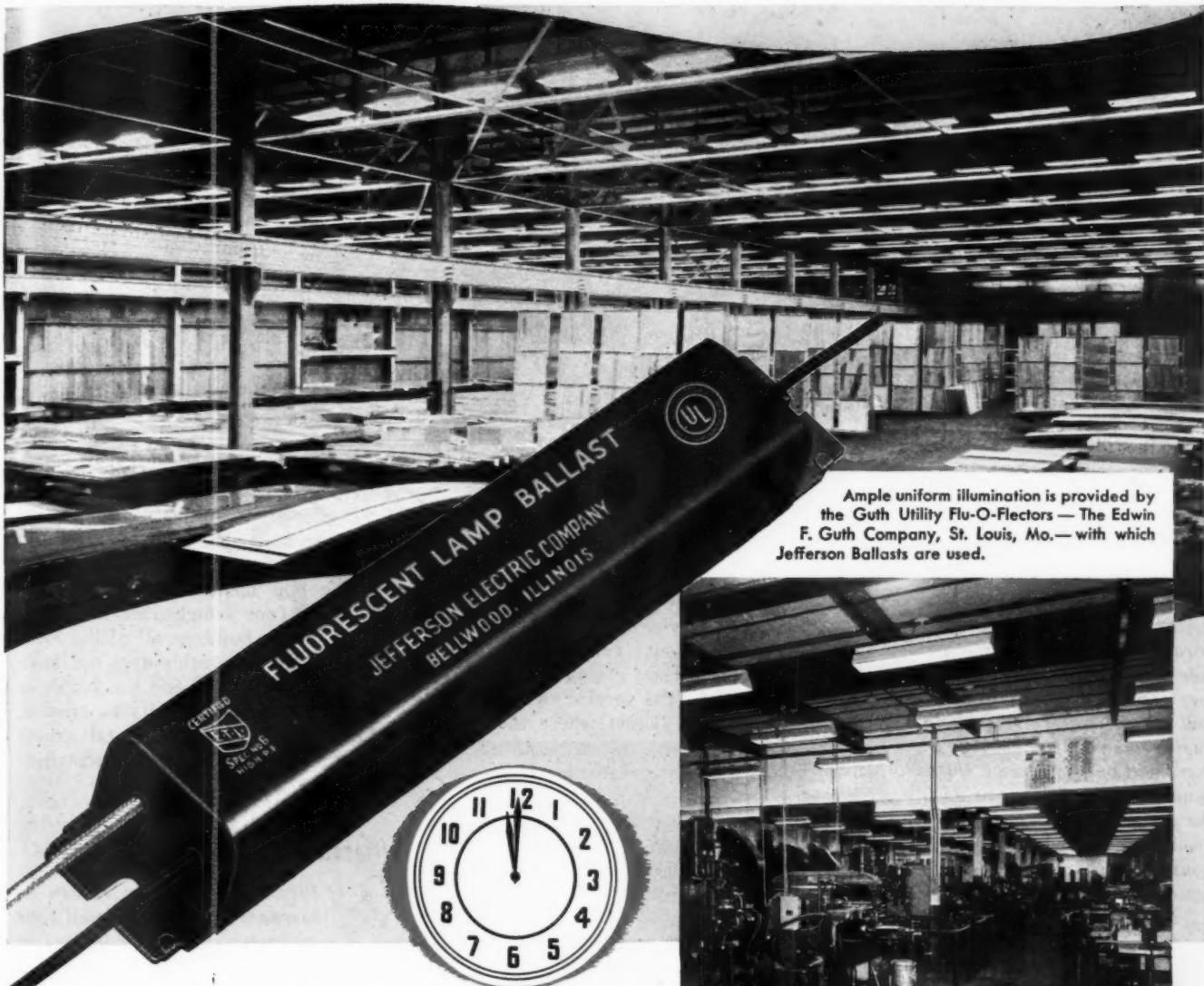
A bent section of $\frac{1}{2}$ -inch steel tube provides a guide for the wire from a spool reel on the floor.

ALIGNING REAMER SET

Reaming out bearings on small motors is accomplished with exceptional accuracy in the new small motor department of the Warwood Armature Repair Company of Warwood, West Virginia.

They accomplish this by using an aligning reamer set which they had made specially for this work. The set consists of a number of reamers for bearings from $\frac{1}{8}$ in. to 1 in. diameter. Each reamer has a long polished shaft, similar to a motor shaft, with a sliding tapered collar thereon.

The bearings to be reamed are installed in the end bells of the motor. The end bells are then mounted to the motor frame, the reamer shaft inserted, the aligning collar placed over the shaft and the reamer turned with the aid of an ordinary wrench. The resulting ream is clean, straight and true.



Round the Clock Production Requires Dependable Fluorescent Lighting and Long-Life Ballasts

• Night and day, plants are busy speeding up essential production—and much depends on the lighting to insure steady peak output.

This 24-hour service demands the best in fluorescent lighting—and the best in Ballasts. Experience in the making of transformers, chokes and controls as used with luminous (neon) tubing mercury lamps, street lamps, X-rays—combined with research, specialized engineering and expert craftsmanship—insure uniform high quality and long-life performance of Jefferson Ballasts.

It is significant that so large a majority of important lamp manufacturers, engineers and contractors insist on long-life Jefferson Electric Ballasts. JEFFERSON ELECTRIC COMPANY, Bellwood (Suburb of Chicago), Illinois. Canadian Factory: 60-64 Osler Avenue, W., Toronto, Ontario.

Ample uniform illumination is provided by the Guth Utility Flu-O-Flectors — The Edwin F. Guth Company, St. Louis, Mo.—with which Jefferson Ballasts are used.



CERTIFIED BY ELECTRICAL TESTING LABORATORIES

LISTED AS STANDARD BY UNDERWRITERS' LABORATORIES, INC.

Lamp design—electrodes, filling pressures, length, diameter, current density, voltage and current, etc.—is based on the best performance of lamps for efficiency, maintenance, life. These basic factors determine the units of electrical specifications for ballasts.

Because of these requirements, the fluorescent lamp manufacturers guarantee the performance of their lamps only when used with those ballasts which meet the specified performance, as tested by Electrical Testing Laboratories, or other laboratories of recognized standing. This is a logical safeguard set up by the fluorescent lamp manufacturers to insure proper lamp performance.

Underwriters' Laboratories approval of equipment requires that the device meet established standards as far as fire hazard and danger to life and property are concerned. Be sure you get Ballasts with the "ETL" Certification label or insignia stamped in the case.

**JEFFERSON
ELECTRIC**
**FLUORESCENT LAMP
BALLASTS**

Questions ON THE Code

Answered by
F. N. M. SQUIRES
 Chief Inspector New York Board of Fire Underwriters

A Service Problem

Q. "In a certain installation it is proposed to run service drop cable from a pole line to a two-car garage, running the standpipe down the side of the garage and placing two meters just inside of the garage. (There will be one meter for each family in a duplex house.) Leaving the meters there will be two service entrance cables running for a distance of 35 feet within the garage and thence for 30 feet underground between the garage and the house and then for 40 feet within the house to two distribution panels.

"The service entrance cable running within both the house and the garage will be Type SE-U cable and the portion underground between the garage and the house will be approved underground cable. (Type U.S.E.) Would such a layout be approved?

"Does the 1940 Code permit the use of this cable in this manner? If so, under what article and section?"—L.S.C.

A. Assuming that at the point of entrance of service to garage there is either a master service equipment (switch and fuses) or a separate service equipment for each meter, then the method of installation as shown is all right.

Section 2351 requires a readily accessible means of disconnecting, (a) "located at a readily accessible point nearest to the entrance of the conductors," and section 2371 requires overcurrent protection for each underground service conductor and (2372) that the service overcurrent device be an integral part of the service disconnecting device or be located immediately adjacent to it.

Section 3382 permits the use of a service entrance cable Type SE or ASE of the so-called "bare neutral" type but having a final non-metallic outer covering as a feeder from a master service to supply other buildings.

Inasmuch as the conductors pass through a service switch and are protected by service fuses where they enter the garage they are considered as feeders and not as service conductors (see 2306) and therefore may run within either or both buildings and inasmuch as they are controlled by the service switch do not need another switch where they enter the house.

There are several manufacturers making ASE cable which is approved for use both above ground and underground, so that it would be possible to use the same cable both in the house and garage and also underground.

Type SE cable would be all right in the house and in the garage but not underground.

Type USE cable would be all right for the underground run but is not mentioned in Section 3382 as being permissible for interior wiring.

But look out for S. E. type U or SE-U-cable. That is not USE cable and is

not approved for use underground.

Section 3382 says that Types SE and ASE of service entrance cables may be used for the interior wiring of buildings but that all of the wires *including the neutral* must be insulated.

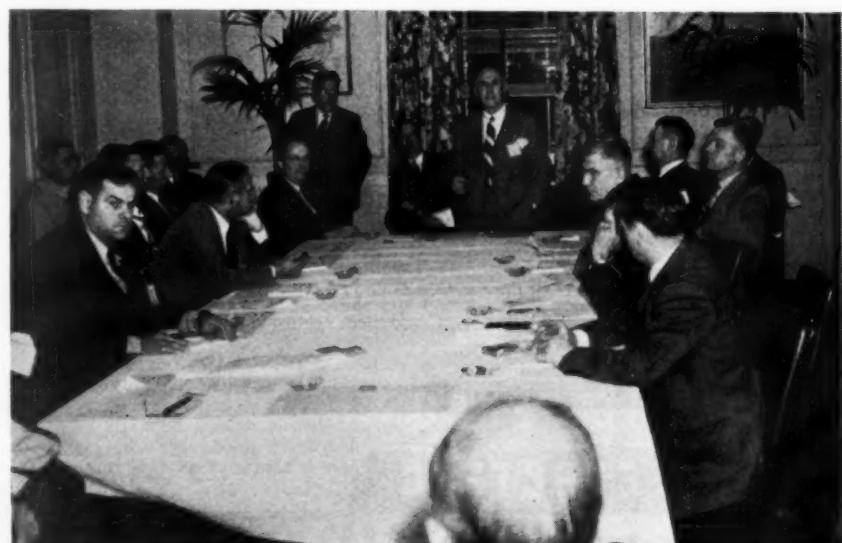
It must be remembered that the SE type cable has not the inherent mechanical protection built into it that type ASE cable has and, where subject to mechanical injury, would require protection which the ASE cable would not require.

In the second sentence of section 3382 the words "without individual insulation on the grounded conductor" mean "bare neutral." Hence the "bare neutral" type of SE or ASE cable may be used as circuit wiring for a range, or as a feeder from master service equipment (service switch and fuses or circuit breakers) to other buildings (as in the case you mention) or as service conductors (not switched or fused) to supply another building, all of the foregoing provided the cable does not have a bare metal covering and the supply is A.C. at not over 150 volts to ground. (The cable may have a metal armor under an outer fibrous "non-metallic" covering.)

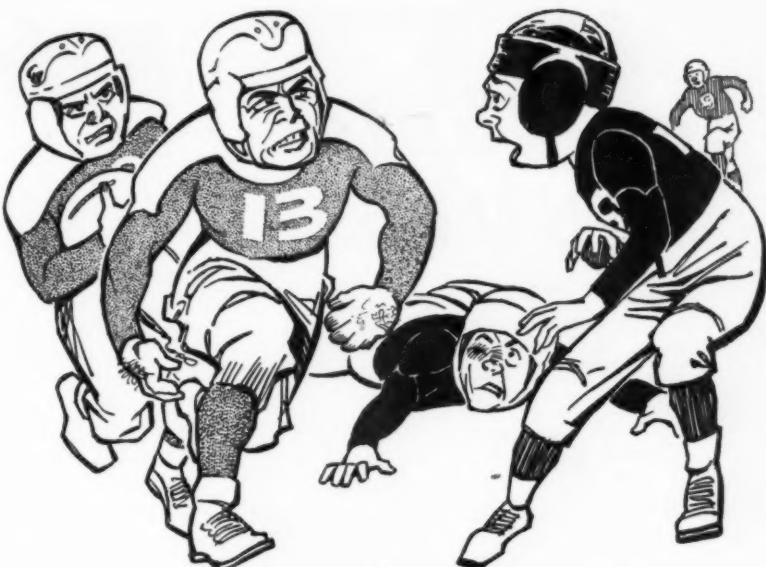
Different Systems

Q. "Please give me the reason or reasons why it is considered poor practice to have a.c. and d.c. feeders in the same conduit. The a.c. and d.c. voltages are the same."—J.C.

A. The first electrical codes (from 1881 to about 1900) did not have provisions against placing the conductors of both d.c. and a.c. in the same con-



OPEN FORUM discussion of state licensing of electrical contractors is led by W. A. Shaw, chairman of Contractors' Licensing Committee, New Jersey Council of Electrical Leagues. Meeting was held at Atlantic City, N. J.



INTERFERENCE

with production costs you time and money — stop it by using



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RENEWABLE FUSES

which protect your plant from needless shutdowns and delays. SHUR-LAG fuses are the simplest, sturdiest, and most serviceable time-lag fuses made, the quickest and easiest to renew, the most economical to use, the most efficient in operation and protection. Get the full story about them from your dealer today, or write for our Bulletin 400.



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FUSE MAKERS SINCE 1893

RUBBER COVERED POWER CABLES • BUILDING WIRE

A Tough Cable For Tough Jobs!

CRESCE NT *Imperial* *Welding* *Cable*

CRESFLEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE CABLE • MAGNET WIRE • BARE WIRE

This cable is of the highest quality, as is the complete line of wires and cables made by CRESCE NT.

The enormous increase in welding required for the manufacture of ships, tanks and other defense items is being met by the use of CRESCE NT Imperial Welding Cable.



VARNISHED CAMBRIC • FLEXIBLE CORDS • LEAD ENCASED AND PARKWAY CABLES • ARMORED CABLE

Questions
on the Code

[FROM PAGE 48]

duit or enclosures, mainly because not much a.c. was being used commercially.

But with the advent and progress of a.c. the Code makers became fearful of the hazards which might result in case the conductors of a.c. and d.c. became crossed and therefore in the early 1900's the National Electrical Code contained the provision that "The same conduit must never contain circuits of different systems, but may contain two or more circuits of the same system."

This same prohibition was, in general, continued to and including the 1937 Code but was changed in the 1940 Code to permit the conductors of different systems to be installed in the same conduit or other enclosure, provided all wires are insulated for the maximum voltage used.

Of course when the prohibiting rule was written and while it was continued in the Code, the rule makers did not have sufficient confidence in the insulations used on wires and especially on splices. They were fearful of the crossing of wires or connections which might introduce direct current onto motor, transformer or other windings with the result of burning them out. Also, of course, they were fearful of introducing lighting or power system voltages onto bell wiring, etc.

Now, however, we have greater confidence in our insulations.

OFFICIAL INTERPRETATIONS

by the

Electrical Committee of the N.F.P.A.

Interpretation No. 212

QUESTION 1 . . . Does paragraph (a) of section 2612 require that the connection to a water pipe electrode for a common grounding conductor be located on the street side of the water meter?

ANSWER 1 . . . No.

QUESTION 2 . . . Does paragraph (a) of section 2612 require bonding jumpers around threaded couplings in water piping that is used as a grounding electrode?

ANSWER 2 . . . No, bonding jumpers are required only around meters and service unions which are in the water pipe line between the point where the grounding conductor is attached and the entrance of the pipe to the building.

QUESTION 3 . . . Refer to paragraph (a) of section 2591. What is the intent of the phrase: "the grounding conductor shall be without joint or splice throughout its length"?

Electrical Contracting, January 1942

CRESCE NT INSULATED WIRE & CABLE CO.

Ask Your Wholesaler

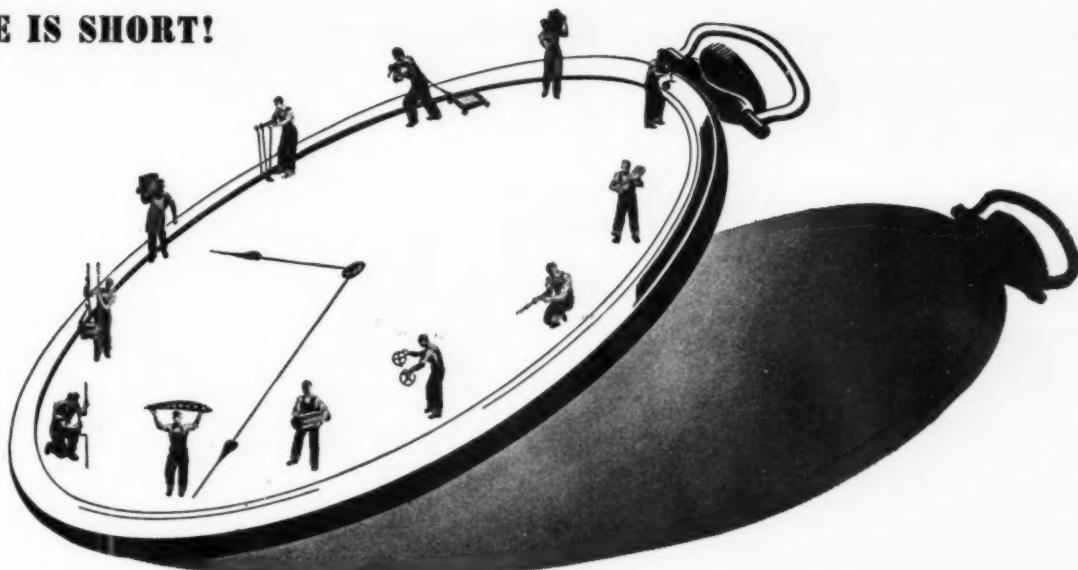


CRESCE NT
WIRE and CABLE

Factory: TRENTON, N. J.—Stocks in Principal Cities

CRESCE NT ENDURITE SUPER • AGING INSULATION

TIME IS SHORT!



8,760 HOURS TO GO IN '42

Men, make the most of them!

A MILLER Continuous Wireway Fluorescent Lighting System can pack more production to the man-hour in your customers' plants

January 1, 1942 . . . 8,760 hours to go! Golden, going hours. Hurry! Hurry!

Industry must put all machines to work. Work machines all the time. Use the most efficient methods. Build an adequate working force. Keep the working force at work.

You can help industry squeeze the last drop of production from each priceless hour by specifying the proven value of continuous-row fluorescent lighting, MILLER 50 FOOT CANDLER and 100 FOOT CANDLER. (MILLER TROFFERS for offices and drafting rooms.)

You can help point up the efficiency of its man-power with 50 foot candles or better of matchless working light . . . as many defense plants have done already.

That's why you will find it worthwhile to have all the working details of the MILLER Continuous Wireway Fluorescent Lighting System always on tap. Write today. (Representatives in principal cities.)

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**50 FOOT CANDLER
100 FOOT CANDLER
MILLER TROFFERS**

Continuous Wireway Fluorescent Lighting Systems

Be sure your customers get these 5 MILLER benefits when they buy fluorescent lighting

(1) **HIGHER ILLUMINATION—UNIFORM DISTRIBUTION** . . . 50 to 100 foot candles for faster, better production and greater worker efficiency. Production equipment can be moved without changing lighting.

(2) **30 TO 50% LOWER INSTALLATION COSTS** . . . Fixtures contain up to 80% of necessary conduit in continuous wire channels—make defense dollars go further.

(3) **FASTER INSTALLATION** . . . Steps up building schedules—goes in with minimum labor—plants get into production quicker.

(4) **SIMPLIFIED MAINTENANCE** . . . Easy to clean, removable porcelain-enamel reflectors—save valuable man-hours for production.

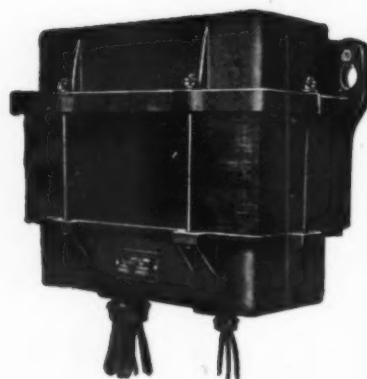
(5) **ALLOWANCE FOR FUTURE LIGHTING NEEDS** . . . Illumination increases up to 45% practical without new fixtures—completely flexible for greater or less light as needs demand—lower obsolescence.

THE MILLER COMPANY
MERIDEN, CONN.

Pioneers in Good Lighting Since 1844

• MILLER offers a complete line of filament and fluorescent lighting equipment.

FOUR POINT ECONOMY—



Below: Type CF, Single-phase, outdoor-type, air-cooled, general-purpose transformer.

Above: Type CFT, three-phase, outdoor-type, air-cooled, general-purpose transformer.



- 1 LOW INITIAL INVESTMENT**
- 2 EASY TO INSTALL**
- 3 MINIMUM MAINTENANCE**
- 4 EFFICIENT IN OPERATION**

Whenever it is desired to obtain a low-voltage supply from a higher voltage circuit you will find AmerTran Type "CF" Air-Cooled Transformers both economical and convenient to use. These moderately priced units may be installed wherever they are needed—either outdoors or indoors*—without the necessity of oil, fire-proof vaults or enclosures. All sizes are equipped with either conduit fittings or a built-in junction box to facilitate installation, and both single-phase and polyphase types are furnished as a single unit. Available in capacities up to 100 Kva. and for potentials up to 2400 volts, all ratings offer low initial investment, minimum installation and maintenance expense, and low operating cost. Let us send data on equipment to meet your needs. Ask for bulletin 1116A.

* Units rated 15 Kva. and larger for indoor service only.

Type "CF" Applications

1. Stepping down power circuit voltage to 115/230 volts for lights, small motors or heating elements. In this way advantage may be taken of lower power rates for low-voltage loads.
2. Obtaining a 3-wire circuit from a 2-wire system.
3. Changing from 3 phase to 2 phase, or vice versa, on a power system.
4. Obtaining low voltage for heating, welding, 32-volt tools, special lighting, testing, etc.
5. Balancing load on 3-phase systems.
6. Insulating one circuit from another.
7. Distributing power at 600 volts or less.
8. Reducing light flicker.
9. Obtaining special voltages to permit efficient operation of equipment.

AMERICAN TRANSFORMER COMPANY

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Newark, N. J.

AMERTRAN
Manufactured Since 1901 at Newark, N. J. **TRANSFORMERS**

PRODUCTS

American Transformer Co. manufactures transformers for every industrial, electronic and laboratory application in sizes up to 10,000 Kva and for potentials up to 132 Kv. Other products: voltage regulators, test sets, rectifiers.

*Questions
on the Code*

[FROM PAGE 50]

ANSWER 3 . . . The intent is to secure a continuous unbroken section through the entire length of the grounding conductor.

QUESTION 4 . . . If a water pipe system used as a grounding electrode consists of copper tubing the joints of which involve either solder or squeeze connections, does paragraph (a) of section 2612 require that bonding jumpers be employed around such joints?

ANSWER 4 . . . No, bonding jumpers are required only around meters and service unions which are in the water pipe line between the point where the grounding conductor is attached and the entrance of the pipe to the building.

QUESTION 5 . . . In applying paragraph (a) of section 2612, is the cold water piping of the premises located on the house side of the water meter to be considered or used as the grounding electrode or as a part of the system or common grounding conductor?

ANSWER 5 . . . It should be considered and used as the grounding electrode. Only the portion of the cold water pipe between the point of attachment of the grounding conductor and the point of water service entrance to the building is involved.

QUESTION 6 . . . Is there a conflict between the texts of the note at the end of section 2594 and paragraph (a) of section 2612 with respect to recognition of rigid conduit and electrical metallic tubing as grounding conductors?

ANSWER 6 . . . There is no conflict. The difference between a grounding conductor and a grounding electrode should be kept in mind.

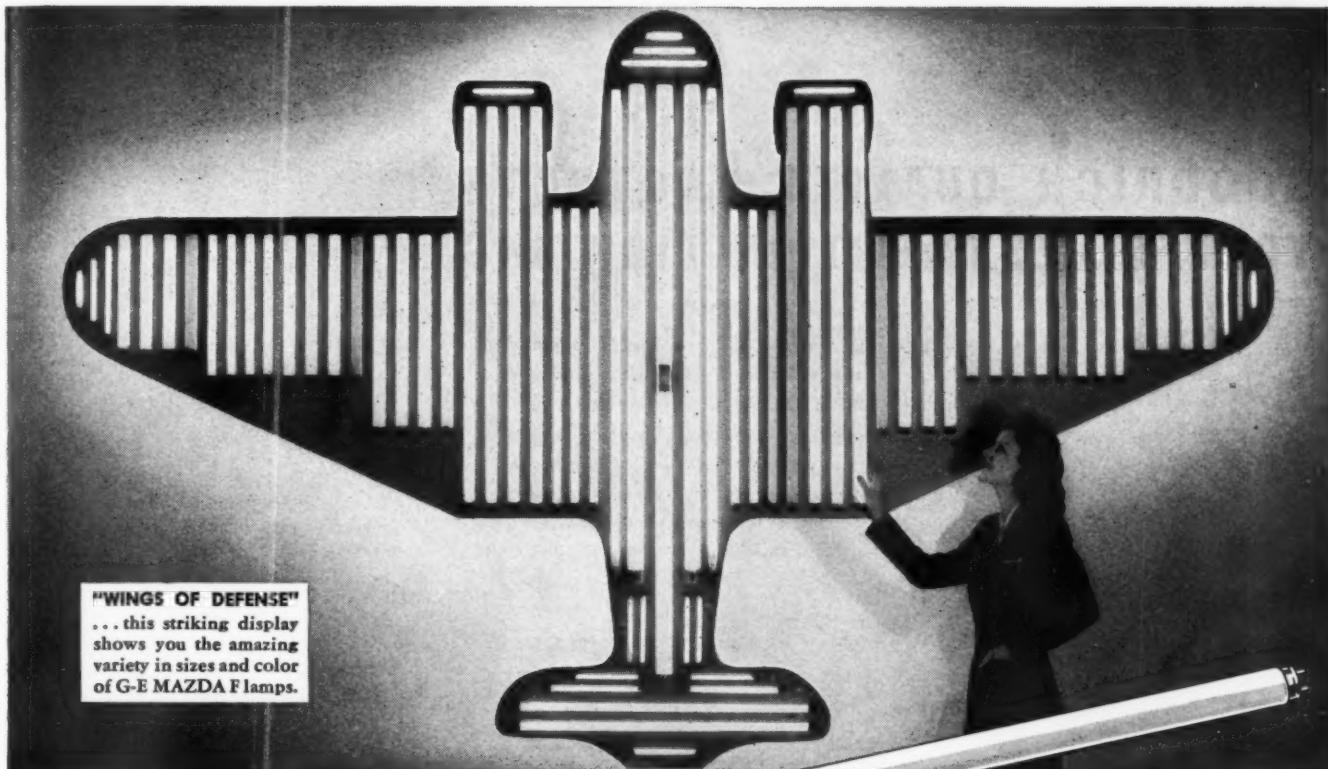
QUESTION 7 . . . Is there a conflict between paragraph (a) of section 2591 and paragraph (a) of section 2612 with respect to the requirement that a grounding conductor of a wiring system shall be of copper or other corrosion resisting material?

ANSWER 7 . . . There is no conflict. The difference between a grounding conductor and a grounding electrode should be kept in mind.

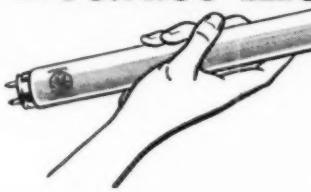
QUESTION 8 . . . Does section 2524 require that a common grounding conductor be installed for all buildings served?

ANSWER 8 . . . No, a grounded conductor of a wiring system may not be the common grounding conductor for equipment and the wiring system.

QUESTION 9 . . . In applying section 2524, must a common grounding conductor for all buildings served be installed?



Because more and more folks want these lamps



•The ever increasing demand for G-E MAZDA F (Fluorescent) lamps has resulted in many

manufacturing economies in our fluorescent factories. In line with long established General Electric policy, these savings are passed along to our customers through the reduced prices on G-E MAZDA F lamps announced below, effective January 1, 1942.

This reduction marks another step in the downward trend of the cost of Better Light for Better Sight. (Since G-E MAZDA F lamps were first introduced in 1938 prices have been reduced as much as 60%). It is particularly significant now, since so many of these lamps are being used to supply cool, efficient "indoor daylight" for defense industries . . . to speed production, cut down waste and protect the eyesight of defense workers.

Effective January 1, 1942

NEW LOW PRICES ON G-E MAZDA F LAMPS

14-watt T-12	was 90c	now 80c
15-watt T-8	was 75c	now 65c
15-watt T-12	was 95c	now 80c
20-watt T-12	was 95c	now 80c
30-watt T-8	was 95c	now 80c
40-watt T-12	was \$1.35	now \$1.15
100-watt T-17	was \$3.00	now \$2.60

Above prices refer to daylight and 3500° white.

Prices also reduced on soft white and colored G-E MAZDA F lamps.

G-E MAZDA LAMPS
GENERAL ELECTRIC

Why

GOODRICH QUALITY PROTECTS YOUR INVESTMENT IN LIGHTING



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*Questions
in the Code*

[FROM PAGE 52]

ANSWER 9 . . . No.

QUESTION 10 . . . What is a reasonable definition of the word "available" in section 2581?

ANSWER 10 . . . In interior wiring "available" means within the building served. In any case the electrode should be accessible to the installer and for subsequent maintenance and inspection.

QUESTION 11 . . . May the neutral bus bar of panelboards, etc., be grounded to metal enclosures, nearby available raceways, etc., other than at the service entrance?

ANSWER 11 . . . No. Refer to sections 2523 and 2552; also section 2559, which forbid the general use of the grounded conductor of a wiring system for a grounding conductor. This is not modified by any of the provisions of Article 338.

QUESTION 12 . . . When conductors in multiple are used in each phase leg of a supply circuit, what value of section 2594 shall be taken in determining the size of the grounding conductor?

ANSWER 12 . . . The value corresponding to the nominal size of the phase conductor that is the sum of the several items in the multiple assembly.

Interpretation No. 215

QUESTION . . . Did the Electrical Committee intend, in connection with the cross reference to section 3346, given in section 3501 of the 1940 National Electrical Code, that a bushing employed with flexible metal conduit where it enters a box or other fitting be of the insulating type and be visible for inspection after installation?

FINDING . . . No, otherwise a conflict with the cross reference to section 3468 would be established.

Interpretation No. 216

QUESTION . . . Will the provisions of the exception of section 4347 be satisfied if one extra set of the "appropriate fuse" is kept at the distribution panel or enclosed switch and what constitutes proper "conditions of maintenance and supervision?"

FINDING . . . It was not the intent of the Electrical Committee that a single spare set of fuses should be accepted as satisfying the conditions. The Committee had in mind that the authority having jurisdiction would be kept in touch with the maintenance practices of the premises and the responsibility of those in charge and that he should be satisfied that only appropriate fuses would be used whatever the condition.

ALUMINUM, THE FUTURE, AND YOU

ALUMINUM,
DEFENSE,
AND YOU

**THE JOB
IS
BEING
DONE**

RIGHT NOW OUR FACTORIES have only one interest: to make more Defense Aluminum than the world has ever seen before. Every resource we can muster is concentrated on that job.

WHEN AMERICA HAS WON THROUGH to make the world safe for our children to live in . . . the saying is: What a lot of aluminum is going to be available for everybody.

THE REAL POINT TO PONDER is how to get set to make that deluge of light metal work for you. In the kind of world we're going to have, sure as fate, the man who fails to call, now, on every resource at his command is going to be left at the post.

WE'VE COINED A WORD:

IMAGINEERING. It's the fine art of deciding where you go from here. It's the act of thinking out what you are going to face, and doing something about it now. *Imagination plus engineering* is a formula for the future you're going to hear more about.

A MAN CAN be producing for Defense at top speed and be imagineering at one and the same time. In fact, the more he is devoted to Defense now, the more he needs imagineering for **THE DAY WHEN**.

OBVIOUSLY, you can imagineer with steel, copper, glass, zinc, plastics, or what have you. We hope you will, because the world is going to need better use of all materials than it ever saw before.

THE CLOSER YOU GET TO FUNDAMENTALS the more quickly you must decide that the great need is going to be for the very things Alcoa Aluminum does best: Lightness with strength, resistance to corrosion, reflectivity, workability and all the rest of its powers all wrapped up in a low-cost package full of unlimited possibilities for you, personally, in your business.

TWO HEADS ARE BETTER THAN ONE. Already, many an industry, many a company, has called us into an imagineering session. We've seen things projected that will make news when the curtain can be lifted. Usually we've been able to help with some imagineering of our own.

DOES THIS SUGGEST ACTION? WE HOPE SO.

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FLUORESCENT • INCANDESCENT

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A DIVISION OF **CONSOLIDATED ELECTRIC LAMP CO.**

Champion Lamps are licensed under General Electric Company incandescent and fluorescent lamp patents. Ask for them and look for the diamond quality mark on every lamp.

Industrial Electrification

ENGINEERING • INSTALLATION • MAINTENANCE

PRODUCTION LINKS

COORDINATING a series of machine operations can be more important than the output capacity of individual machines. For it is in the unequal ebb and flow of parts and partially finished products that production jams occur.

Automatic sequence and close coupled production is largely an electrical problem requiring planning and careful maintenance. When a complete process is a series of coordinated operations, breakdowns must be quickly restored, repairs readily available.

Interlocking and timing a series of dependent operations requires a ready knowledge of motor characteristics and control apparatus. It calls for better-than-usual lighting practice. And the electrical equipment used must be selected with more concern for precision and reliability than for price.

But smoothing out the flow of materials and processes is not always a complex job of interlocked control. It may require only a simple conveyor belt, a heat tunnel or a rolling hoist. Always, however, the application of continuous operation aids must be thought out in terms of the whole process.

The following pages discuss several aspects of continuous operation and the Check Chart shows points to consider in maintenance.

Previous articles covered—

1. Simplifying Electrical Maintenance
 2. Preventive Maintenance of Distribution Systems
 3. Preventive Maintenance of Electrical Equipment
 4. Reducing Power Costs
 5. Maintaining Good Power Factor—Part I
 6. Maintaining Good Power Factor—Part II
 7. Meeting Severe Service Conditions
 8. Eliminating Causes of Severe Service Conditions
 9. Providing Adequate Capacity for Increased Demand
 10. Electrifying Operations to Reduce Unit Costs
 11. Safety Protection for Electrical Operations
 12. Increasing Flexibility of Electrical Service
 13. Electrical Aids to Automatic Control
 14. Electrical Ways to Reduce Waste
 15. How to Save Power
 16. Protection Against Sabotage
 17. Improving Working Conditions
 18. Electrifying for Continuous Operation (this issue)
- Future articles will discuss—
19. Electrical Aids to Quality Control
 20. Electrified Plant Housekeeping

ELECTRIFYING FOR CONTINUOUS OPERATIONS

HERE is throughout industry a strong trend toward the more general use of continuous operations in both the automatic sequence and the close-coupled step-to-step classes. In almost every advancement along these lines, more electric motors, generators, control devices and power and control cable are required. Along with these go distribution, regulation, protective, heating and lighting equipment so that installation time and costs become major considerations.

The high pressure on production for wartime has stimulated study toward shortening and quickening processes. With his knowledge and experience, the electrical man is in a strategic position to suggest and carry out plans to these ends.

When a number of machines perform individual operations in sequence on a single piece of material we can be sure that the process planners, the machinery and electrical men have cooperated in every detail and that many a stumbling block has been overcome before success was attained.

Electrical Man's Responsibility

Most sequence operations call for considerable engineering ingenuity particularly if several machines are working on the same piece of material. The prime requisite here is to keep the machines in step, with due allowance for come-and-go due to shrink or stretch as the material progresses.

A considerable knowledge of motor

characteristics is desirable, especially as to speed adjustments that are most practical for the job. With this naturally goes control for each type of adjustable or variable speed motor, range of speed required, and fineness of speed regulation.

One planning such applications must be cost conscious as there can be a wide span between just-good-enough and the ideal. Where it is planned to make production a fast sequence project it is necessary to give lighting more than ordinary thought. There are fewer opportunities for inspection and most of them must be made on moving material. The least that can be done for those responsible for the uniform flow

BY MEANS of the endless conveyor system and an infra-red tunnel, Lockheed couples a step-by-step process together into a continuous operation.



of specification material is to provide the best possible lighting. Fortunately there is not as great a range of costs involved as in power applications.

Automatic Sequence

A good example of a comparatively simple motor and control application to automatic sequence production is afforded by the cloth finishing "range".

The production of textiles includes weaving and finishing. The latter consists of many operations carried on in finishing plants, often not a part of the weaving plant.

Until a few years ago these operations were done individually on the pieces of goods, lengths being limited by the warp that the loom will hold for one run. The piece was run through one process and into tote boxes to be wheeled to the next machine which might be faster or slower causing a large accumulation of tote boxes here and there. Operations on several floors complicated the transfer situation.

The range drive introduced real sequence operation, reduced costs and space required. The range consists of three to ten or more pieces of motor driven process equipment, usually in line, and with independent and automatically adjustable speeds. No conveyors are needed as the fabric is drawn through leaders or over rolls from one process to the next. Before a "piece" of goods is exhausted from the feed box or roll at the head of the line, another piece is sewed on so the finishing processes go along without stop for miles and miles until the order is completed. Up and down stairs is no obstacle, in fact, some ranges are on

three floors. Some processes, such as bleaching require an aging or rest time before the next operation. Subsequent machines are started say an hour later than the bleacher and its preceding units. An hour's output of goods accumulates on an aging table, then when the subsequent machines are started there is always an hour's rest for the goods at this point in the sequence no matter how long the range is run. There are four electrical systems that are used for range drives and each has called for the best efforts of electrical men in cooperation with the cloth finishers and the manufacturers of the process equipment. The range drive introduced many more motors, motor-generator sets, individual and range control devices, roller gate rheostats and other electrical adjuncts but they, by doing away with the batch system, brought order and speed to finishing.

In the following example, a hasty survey of a situation indicated a heavy expense and long delay. A more deliberate study by the mill electrical men revealed a better solution.

A cleaning line in a strip steel mill involves a long line of units for pickling, washing, leveling, trimming and reeling the steel after it comes from the rolling stands. In a recent case where the mill line was speeded up, the cleaning line at 800 feet per minute appeared to require a second line to keep up with production. Means were found however to speed up the line to 1500 feet per minute by re-motoring some of the units. Drag generators holding tension on the reel remained as they were. Nearly doubling the speed required some readjustment of details of operation but these, together with a few

larger motors, saved the expense and space of a new line.

Sequence operations on separate units as distinguished from work on one piece of material offers far greater opportunities for the electrical man. In between the process steps, there are many kinds of delays that may be reduced or eliminated by a careful study. In some cases it will be found that individual operations are too slow or are not properly located with respect to other operations or the operations may not be arranged in the best sequence.

Materials Handling

One of the most prolific sources for improvement in most plants lies in material handling. The introduction of small hoists to supplement cranes or to take the place of manual lifting and moving can be carried out without great loss of time. Many types of small electric hoists are available and a moderate amount of shop work and wiring will put them to work.

Another device that finds many worthwhile applications is the conveyor. It need not be an elaborate built-in system for there are many places where short conveyors will bridge over an interruption in an otherwise orderly process. Portable types bought ready to use may require wiring to outlets in handy locations. Such conveyors are used to unload stock from cars, for reclaiming material from stores or to move partly finished products from one room or building to another. Wherever one sees hand trucking or tote box pushing going on is the place to start sketching a conveyor scheme.

The battery-powered, burden-bearing trucks, towing units or elevating devices can do much to relieve space congestion caused by the slow and too intermittent movement of material in process. Especially useful are the piling devices, used in warehouses, car loading, outdoor storage and withdrawals of heavy units.

The introduction of battery-powered units calls for battery charging equipment, now mostly of the electronic tube type with automatic control. Charging equipment may be portable or fixed in place, in either case installation of wiring and outlets covers about all the shop work needed.

If the observant engineer notes continuous braking going on for holding tension for instance, on out-winding rolls of material, he may consider the use of a small a.c. or d.c. motor for use as a "drag-generator". Such a unit provides excellent braking service, readily adjustable, and non-wearing. The d.c. adjustable speed motors give the



MOTOR DRIVES and control elements for a "flying shear" used in connection with steel rolling. The shear cuts the product into pieces with great accuracy while stock is moving at high speed. Timing is wholly electric, there being no mechanical tie with rolling stand. (G. E. photo.)

MAINTENANCE GUIDE SHEET

GOOD MAINTENANCE PROCEDURE TO INSURE CONTINUOUS OPERATIONS

KNOW YOUR PLANT	ITEM	SOURCE	ANSWER
Power Supply:	What is the total capacity of incoming line, transformers, or generators? What are short and long time overload limits?	Name Plate Rating Check with Mfgr. or Power Co.	..... .....
	What are present loads, swings and sustained?	Recording Meters	.....
	What is overall power factor?	P. F. Meters or Power Co.	.....
	What is voltage at source and after main transformers?	Voltmeter Readings	.....
	What is main switch capacity, or other limiting factor?	Switch or Equipment Rating	.....
	What is condition of main switch or other limiting equipment?	Inspection	.....
Main Feeders: Sub-Feeders: Branch Circuits:	What is total current carrying capacity of each circuit?	Code rating of known wire sizes	.....
	What is present load on each circuit?	Ammeter Readings	.....
	What is power-factor on each circuit?	Volt, Ampere and Watt meters	.....
	What are voltage conditions on each circuit?	Volt readings both ends of circuits under load	.....
	What are conditions of circuits?	Type wire, how installed, where located, air temperature, age	.....
Panel and Switch-boards: Splice boxes:	Are distribution panels located in cool places?	Check ambient temperatures	.....
	Are panels and switchboards free of dust and dirt?	Inspection	.....
	Do fuse and switch clips have proper tension?	Inspection	.....
	Are fuse and switch blades and clips clean and bright?	Inspection	.....
	Have copper parts lost their temper from overheating?	Inspection	.....
	Are supports in good condition to insure freedom from grounds or shorts?	Inspection	.....
	Are connections firm and clean?	Inspection	.....
Motor Loads: Type and amount:	Are motors operating close to rated capacities?	Ammeter Readings	.....
	Are correct types of motors applied to loads? Speeds and torque?	Knowledge of Loads	.....

PREPARE FOR WARTIME EMERGENCIES

Important and Essential Loads:	Are there direct lines from power source to make these independent of other failures? Can any splice, fuse or switch connections be eliminated in power line?	Transformers:	Are spare transformers available? Can present transformers operate open delta to carry essential or major portion of load?
Transformer Temp.	Are duplicate circuits with automatic throw-over switches desirable? Will looped feeders insure better voltage and more firm power supply?	Spare Feeders:	Are spare feeders available in essential or major load areas? Are spare conduits or ducts now installed?
Transformer and Switch Oil	Use thermometers permanently attached with danger signal	Relieving Over-Load:	Are there locations where distribution circuits can be tied together to allow cutting out portions of line?
Plant Voltage	Test periodically for insulating value		Are "jumpers" ready so that some equipment can operate while failures are being repaired?
Fuse & Switch Temperatures	Check throughout plant as an indication of trouble, grounds, or overloads		Can power-factor be improved by capacitors to relieve line and transformer overload from wattless current?
Wiring Connections:	Check periodically for overload and condition of clips, blades and contacts	Fire:	Can radial feeders be converted into looped feeders to increase capacity and improve voltage?
Motor Temperatures:	Check for firm contact and condition of lugs, especially where vibration or fumes may be present	Planned Work:	Are correct types of fire extinguishers immediately available for electrical and oil fires?
Sight-meter Readings:	Check for load changes, such as added machines, speed up of equipment, belt slippage, bad bearings, misaligned shafting		Has a plan been devised for the relief of each type of emergency?
	Take periodically to check lighting system condition—dirt, old lamps, bad paint		Has the plan been explained to each member of the crew, so that regardless of time, the crew is prepared?

BEST ANSWER TO MOTOR BEARING PROBLEMS



IN 1930
AND
TODAY

Westinghouse Sealed- Sleeve Bearings keep oil IN . . . keep dirt OUT

Motor users need two kinds of bearing protection to avoid costly delays in today's tight production schedules: (1) Against oil leakage that leads to dry bearings and burnouts; (2) Against infiltration of dust and dirt which causes scoring and excessive wear. Westinghouse Sealed-Sleeve Bearings protect you both ways.

"Oil sealed in—dirt sealed out" rang the bell with

motor buyers before 1925. They tried the motor. They found it lived up to its reputation. Judging by the number of industrial buyers now ordering CS Motors for the exacting grind of emergency production they like the idea better than ever today.

Along with the cast frame and Tuffernell insulation, sealed-sleeve bearings are a special feature of CS Motors, largely responsible for their present wide acceptance.

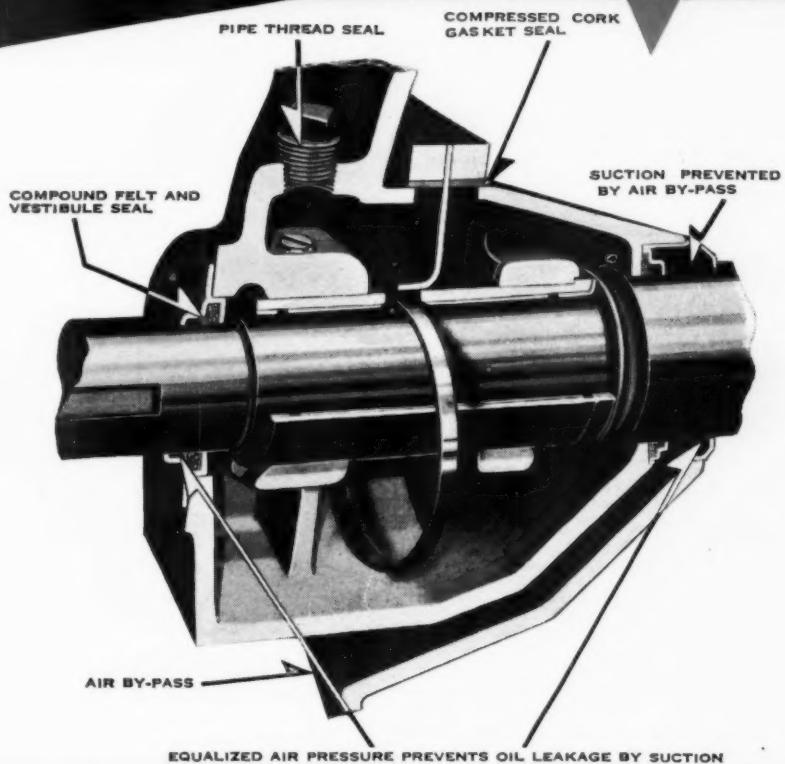
Many of the earliest motors equipped with sealed-sleeve bearings, are still in service today with the original bearings. The advantages of this basic design are now augmented by improvements based on more than ten years of operating experience.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO., EAST PITTSBURGH, PA.

Westinghouse



SEALED SLEEVE BEARINGS



Only in Westinghouse CS Motors do you find the complete protection against dirt and dust of the dual felt gasket and vestibule seal along with the Westinghouse air by-pass which equalizes air pressure inside and outside so that oil leakage due to suction is positively prevented.

RENEWAL PARTS AND SERVICE

Not only for current models, but for any Westinghouse Motor or control device ever built, Westinghouse assumes the responsibility of providing renewal parts. They are made to the same rigid standards as the original equipment. Parts are therefore interchangeable and maintain the original performance.

The 34 district manufacturing and repair plants are so located throughout the United States that parts or service are available overnight wherever your plant may be.

ONE-PIECE FRAME

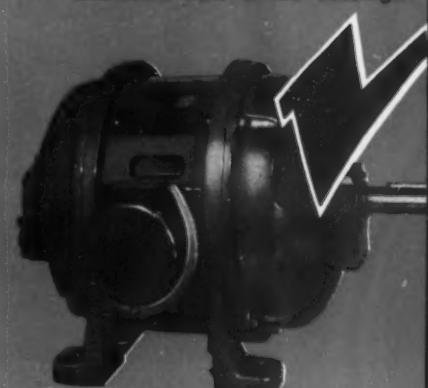


The integrally cast frame of the Westinghouse CSMotor, developed and introduced by Westinghouse, protects the electrical elements fully against twisting strain and vibration.

TUFFERNELL INSULATION



Includes the Westinghouse insulating slot cell, plus taped end turns giving extra strength at the most vulnerable spots. The final dipping and baking completes the protection which resists abrasive wear due to dust, dirt, and grit. In addition to the standard A.I.E. tests each Westinghouse CS Motor must also pass the Westinghouse Radio Frequency test—the only test which detects flaws and weak spots in insulation between each individual turn of the windings.



Type CS Motor with sealed-sleeve bearings, one-piece frame, and Tuffernell insulation.

J-21177

Type CS Motors

better service as field adjustment provides the desired tension. Rider-roll rheostat control makes the tension constant regardless of diameter reduction of roll.

Local applications of electric heat are easily carried out with normal electrical facilities. Heating units are available in a great variety of forms and a little ingenuity will bring about decided improvements. Heat may be applied by means of bare ribbon, armored rod or finned rod for extensive areas. Cartridge units in various forms are handy packages of heat often calling for the simple drilling of a hole in which to insert the unit and a little wiring.

Electric heat serves to melt soft metals, heat soldering irons, warm glue pots, warm otherwise stiff material for bending operations, branding, etc. Where fuel fired devices are displaced, better working conditions result. A rather new appliance to provide heat for drying is the infra-red lamp. Banks of lamps may include only a few portable units or they may line a large tunnel in the process line. Almost unbelievable stepping up of drying processes result from this system.

Wherever human judgment is required for detail control of processes, time must necessarily be consumed to avoid an excessive amount of rejects. The use of electrical instruments and other means to relieve operators of tedious and exacting duties is doubly worth while. They may eliminate stops to measure or test, they can speed up a process because they are quicker than the eye, they save wastage, and they make the job more desirable for the personnel.

Step-to-Step Processes

It is in the nature of things that production of many items must proceed by a series of batch operations. When the system is perfected to the point where the batches between steps are reduced to single items which are hardly allowed to come to rest, the nearest approach to continuous sequence operation has been attained. Such a condition prevails in modern saw mills. The "cants" sawed from the logs fall on live-roll conveyors and from there clear through the mill to the automatic lumber piles, there is no stop, and no accumulation between steps. The head sawyer sets the pace for the whole mill for if he lets down for five minutes, a little later the piler will stop piling for five minutes.

Step-to-step production is quite likely to proceed for months or years as it was first successfully worked out. Those in intimate contact with the line of

operations are not likely to see where improvements can be made—they are "mill-blind" to what is going on around them. The electrical man, being familiar with achievements in other places and having confidence in the ability of electrical equipment, can see opportunities and suggest changes that work wonders in process economies.

A good example of a short cut suggested by an electrical man, is afforded by the introduction of "poney" lehrs in the production of glass ware, such as pharmacy goods, i.e. medicine bottles. Glass blowing machines turn out bottles at a high rate. In the old way, the bottles were allowed to get cold then were carried to a large centrally

clean. It saves breakage incident to washing. It pleases users of the ware so much that they specify "electrically annealed".

A plant having a very large floor area depended upon fast operation of bridge cranes to keep production up to schedule on large units. Cranes were sluggish when at the far end of runs away from the incoming power. Shop electricians found excessive voltage drop and laid it to the resistance of the trolley rails. Copper cables were laid along each rail and were brazed on at intervals. Only a slight improvement resulted. The engineers concluded that the spacing of cables and rails was at fault causing high impedance. A model was made and tested to find the most economical spacing. A rearrangement of the conductors brought the voltage drop to a negligible value, the cranes were speeded up and the hoist motor torques were improved.

A shipyard was having trouble at the fitting out docks in handling crane loads heavier than the power distribution system had been designed for. Reinforcing the system meant tearing up, delaying work and great expense. A way out was found by the electrical men who installed a portable mercury-arc rectifier which is moved to any crane that is faced with a big lift. The rectifier supplements the normal d.c. source and extra heavy loads are now handled quickly and safely.

Smaller Motor

A fast cycle hoist was frequently out of service because of overheating of the hoist motor. The motor horsepower rating was fully adequate for the job. A study of fast reversing cycle problems revealed the too high wr^2 or fly wheel effect of the motor. The rapid and frequent accelerations took so much current that the motor overheated even with no load on the hook. A motor of somewhat lower horsepower rating, and only 40 percent of the wr^2 of the old motor, was substituted with entirely successful results.

Maintenance

Electrical maintenance men are in a position to keep production in a highly satisfactory plane through well planned maintenance programs. The cost in man-hours and material for restoring a unit to service is usually of minor importance as compared with loss of production and damage to other equipment.

A card file of electrical equipment should show when and why repairs or overhauling were necessary and, most essential, what was done to ward off a

[Continued on page 66]

Let

CENTURY MOTORS Help You Get Your Share of Defense Business



Alert electrical contractors throughout the country are finding an increasingly profitable market for electric motors among factories, cantonments, and defense projects.

Such new production, whether as a primary or subcontract, almost invariably calls for new equipment or for rearrangement of existing machines. These defense industries offer a big market for Century Motors of all types.

Because of Century's exceptionally wide range of motor types and sizes—fractional and integral up to 400 horsepower—you can be sure that a Century recommended motor will correctly meet the load requirements of the job and those of the surrounding conditions.

You'll find it both helpful and profitable to call in your Century representative right now.



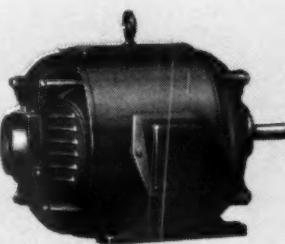
CENTURY ELECTRIC COMPANY

1806 Pine Street St. Louis, Missouri

Offices and Stock Points in Principal Cities

*One of the Largest
Exclusive Motor and
Generator Manufacturers in the World.*

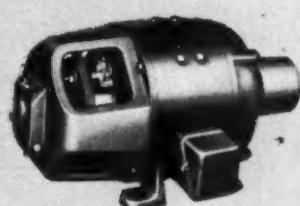
244



Century Repulsion Start Induction Motor for hard-to-start loads.



Century Open Rated General Purpose Motor.



Century Direct Current Motor for all DC applications.



Century Capacitor Motor with cushion base.

These little "Inch-Marks"



"Make Yards of Profits

WHEN YOU USE
"INCH-MARKED"

PAT. APPLIED FOR

ELECTRUNITE Steeltubes



BIG. U.S. PAT. OFF.

Thirty-six inch-marks on a foot-rule make a yard, but the little "inch-marks" on every length of "Inch-Marked" ELECTRUNITE STEELTUBES make yards and yards—OF PROFITS—for contractors who use this improved E. M. T.

Your mark for cutting a short length—or for making a bend—already is made for you—and made ACCURATELY. There's no slipping of foot-rule or pencil just as you are about to measure and mark the tubing—consequently, LESS CHANCE FOR ERROR, for cut lengths or bends that do

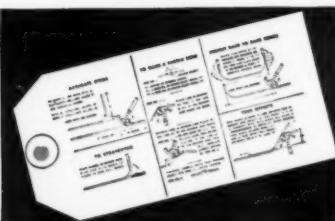
not fit—and LESS WASTE of tubing on the job.

The new ELECTRUNITE Bender shown below—a one-piece casting with instructions built in—will help you lengthen your profit yardage, too. It was designed to enable you to use "Inch-Marked" ELECTRUNITE STEELTUBES to best advantage in making bends by hand, quickly and easily.

Tell your ELECTRUNITE Distributor that you want to use "Inch-Marked" ELECTRUNITE STEELTUBES on your next wiring job. (It's approved by the National Electrical Code for exposed, concealed or concrete installations.) Try it yourself. Ask your workmen how they like it. See what a world of difference a few "inch-marks" make—how much easier and more accurate they make raceway installation. See, too, how they save money for you and increase the yardage of your profits. Steel and Tubes Division, Republic Steel Corporation, Cleveland, O.



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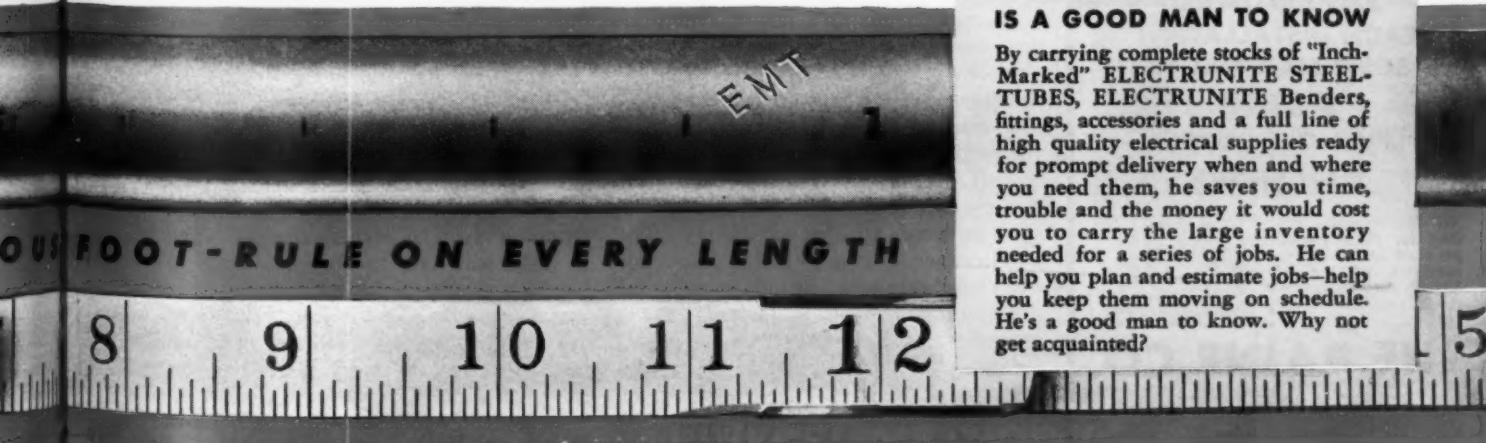


This new bending tag, supplied with each shipment of tubing, provides complete bending instructions and diagrams for making various types of bends.



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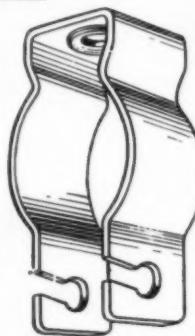


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recurrence of the trouble. Under present production conditions there is little time for detailed inspection hence the greater necessity for a program.

A schedule, showing when every piece of equipment will be available for check up, should be made and adhered to as far as possible. A selection of portable instruments should be available for regular readings to show megohms resistance, for instance, so that deterioration can be detected and steps taken to ward off a break-down.

Preventive maintenance consists in heading off trouble that is on its way to your plant to happen. The habit of making the same repairs on the same piece of equipment as a matter of course, should be discouraged. There are reasons for every failure and if they can be eliminated a worth while gain has been made.

A card file in a mill showed several



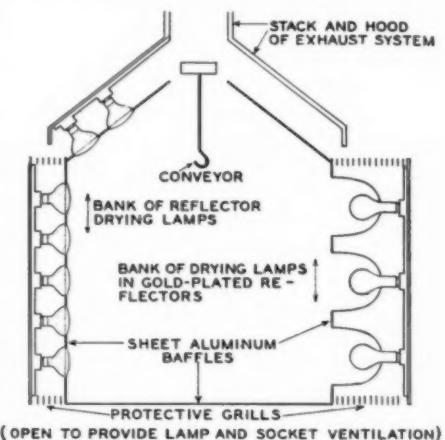
THIS VIBRATORY FEEDER keeps material free running and increases production 20 per cent at Emerson Drug Company, Baltimore. (Syntron photo.)

pulley-end bearing failures on a large motor that was pulling a heavy fly wheel load. An investigation showed that the man who started the motor did not allow enough time for acceleration and the belt would slip and run off. He repeatedly tightened the belt so it would stand the grief, but the bearing suffered. A little instruction in the manipulation of the compensator starter lever cured that bearing trouble.

In another plant, a larger synchronous motor on important duty would shut down for no apparent reason. Inspection and overhauling failed to cure the trouble. Finally it was found that the starting up of another large motor in a different department was causing a voltage dip, bad enough at times to trip the synchronous motor off the line. The maintenance engineer had a capacitor installed where it would reduce the dip and the trouble was ended. These examples go to prove that the maintenance man needs to be something of a detective if he is to keep troubles from repeating. Record cards properly kept will often supply the clues he needs.

Constructing Drying Lamp Tunnels

When building drying lamp tunnels, it should be kept in mind that one or both sides should be movable for easy maintenance. The enclosed tunnel illustrated below is equipped with sheet aluminum baffles to prevent strong convection currents from cooling the work



COMPOSITE SKETCH showing a cross sectional view of a typical drying lamp tunnel using either the reflector type lamp or lamps and reflectors.

and to redirect stray radiation toward the work. Baffles should be placed in line with the faces of the reflectors or at the maximum bulb diameter of the reflector lamps. If placed farther back, unsatisfactory socket and lamp operations may result from heating these to excessive temperatures.

Lamp ovens require no insulation since their operation is dependent upon the absorption of radiant energy which is turned into sensible heat within the work. Sheet metal enclosures conceal wiring and control ventilation of sockets and lamps.

Seven Aids to Continuity

1. Is a running check kept on the hourly performance of your new equipment and processes? Automatic recording and measuring instruments are available for nearly any requirement.

2. To maintain uniform output, is equipment properly interlocked where incorrect timing of sequence operations might cause lags?

3. Inadequate wiring often is an important bottleneck. Is the electrical distribution system periodically surveyed to make sure that it is always ready to handle a reasonable added or emergency load? If the circuits are overloaded have you considered putting in new thin insulation wire to carry greater power in existing conduits?

4. Do you make sure that the motors used will develop the machines' full

rating and at the same time avoid over-motoring? A check on conditions with a power company engineer, or equipment manufacturer will often develop useful information.

5. How quickly after the whistle blows does each department reach its set rate of production? In machine operations this can be computed from instrument readings on power consumption. If the drag is longer than ten minutes there usually is an opportunity for profitable correction.

6. How much time is lost because of fuse blowouts on temporary overloads? Quick reset circuit breakers will reduce this.

7. Do modern control and safety devices such as the photo-electric cell make operation of your equipment fool-proof?

Production Costs Cut by Welding

The manufacture of coal hoppers and press brakes was a slow process at The Paterson-Leitch Company, Cleveland. Prior to welding, riveting was the means of fabrication and much time was taken up by rivet-heating and hole punching. Now with General Electric arc welding, this time has been eliminated and the product is lighter and better appearing.

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N. H. Bolz, Gen. Supt., states, "We have increased our sales 50 per cent, saved as much as 40 per cent in overall production costs, reduced manufacturing time 40 per cent, through the use of our new welders and electrodes in the fabrication of coal hoppers and press brake housings."



ELECTRIC WELDING with portable welding units cuts production costs in the manufacture of these coal hoppers. (G. E. photo)

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Reader's QUIZ

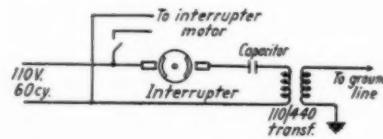
QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published, we pay \$5.00.

LOCATING GROUNDS

QUESTION 33. How can I locate a ground on one phase before another develops on a second phase, while equipment is still operating? The system is 3-phase, 3-wire, 440-volt alternating current supplied by two banks of three single phase transformers. Secondary buses run into a switch house feeding 16 different circuit switches, which furnish power, underground, between buildings, operating practically seven days a week. We have ground detector lights connected to the main buses which show when and on which phase a ground is developing.—H.E.B.

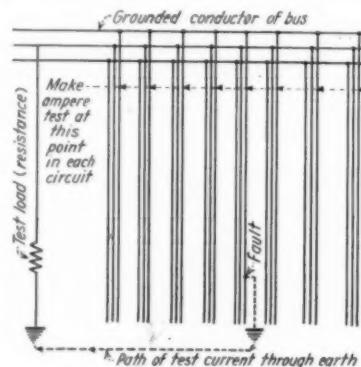
A. TO QUESTION 33. The equipment shown in the following diagram is used to locate grounds under the conditions mentioned on a 440-volt system serving 1600 motors. This equipment consists of an interrupter made from a 2-in. diameter by $\frac{1}{2}$ -in. thick micarta disc carrying two copper segments and driven by a 1/20 horsepower motor. The interrupter is connected in series with a capacitor and the primary of a small air cooled 110/440-volt transformer. One 440-volt lead of the transformer should be grounded and the other lead attached to the grounded phase of the live 440-volt circuit through a suitable fuse.

The interrupted current will send a low frequency signal out over the grounded phase returning through the ground to grounded side of the 110/440-volt transformer. This signal can be followed to the fault by using an exploring coil and a telephone receiver, similar to that used for locating grounds in telephone cables.



We use five one microfarad condensers each switched so that the capacity of the circuit may be varied. It may be necessary to add an inductance coil in series with the condensers to provide the necessary phase shift to secure the maximum signal. However, the circuit is not at all critical and usually the equipment to assemble a workable "rig" can be found about the average shop.—B.C.M.

A. TO QUESTION 33. Since one conductor is grounded, the other two conductors of the bus and of each circuit have a voltage of 440 to ground. Connect two or three kw. of resistance type load, such as strip heaters, between the ground and one of the live conductors of the secondary bus. This will



set up a current of say, five amperes through the grounded wire. Check the current in the grounded conductor of one of the sixteen circuits. By making and breaking the circuit to the resistance load, you can observe whether the five amperes of current is flowing

through that circuit to the ground. Repeat this test on the grounded phase of each circuit until the movement of the ammeter pointer discloses the circuit which is providing the path to the ground for the test current. After the faulty circuit is located, similar tests along it will reveal in what portion the ground is located. See connection diagram below.—H.R.

FAN BLADE VIBRATION

QUESTION 34. I have a d.c. fan which causes me much time and worry. I want to get a shimmy out of it, which I blame on the blades being out of line. I have tried many methods in lining up the blades but none have been successful. Please give any information on an instrument or methods I can use to put the fan in good running condition. This fan with many others has caused the loss of much time per fan. Any quick and simple method would be very much appreciated.—H.E.W.

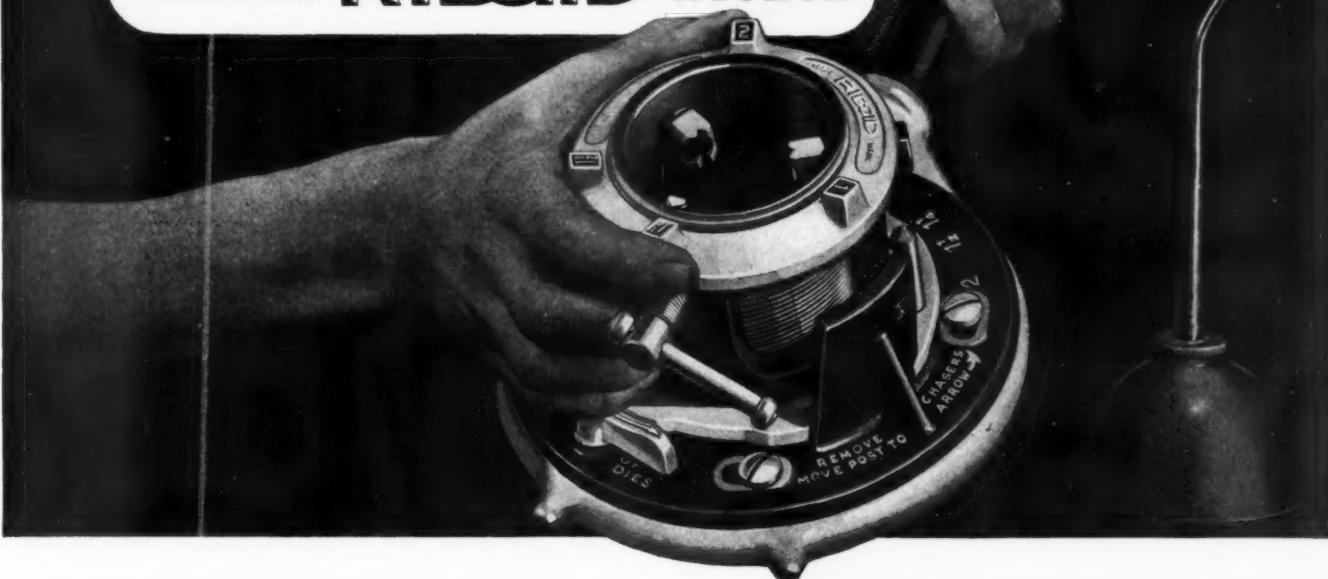
A. TO QUESTION 34. Mount the fan blade in a universal chuck, in a lathe large enough for the blades to revolve freely. With a tool holder in the carriage, check the alignment of the blades, as they are rotated slowly. When the blades are true, place a mandrel in the hub of the fan blade, and balance it as you would any rotor or armature. The above procedure will cure any fan blade trouble.—L.A.H.

A. TO QUESTION 34. If the blades of a fan are out of line it certainly will shimmy and wobble. There is no simple way by which you can repair the blades once they have been bent. The quickest and cheapest thing to do is to buy a complete new blade from the manufacturer of the fan. Expensive gages, tools and dynamic balancing equipment are used to make fan blades but are not usually available for repairs in the field.—G.H.H.

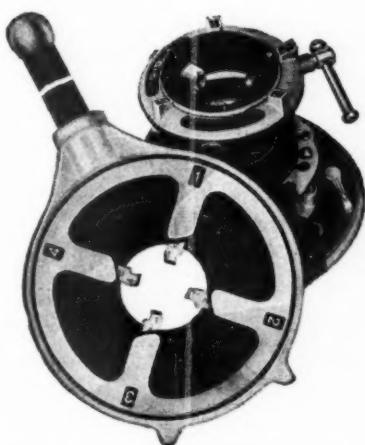
WELDER POWER SOURCE

QUESTION 35. What size transformers are required to supply 440-volt power, to 12 spot welders rated 3-75 kw., 1-150 kw., 3.15 kw., 1-25 kw., 2-17 kw., 1-10 kw., and 1-12.5 kw. The 75 and 150 kw. are equipped with automatic timing range 5 to 12 cycles. At present these are supplied from the regular 3 phase power supply. welders staggered on phases. Can we use single?

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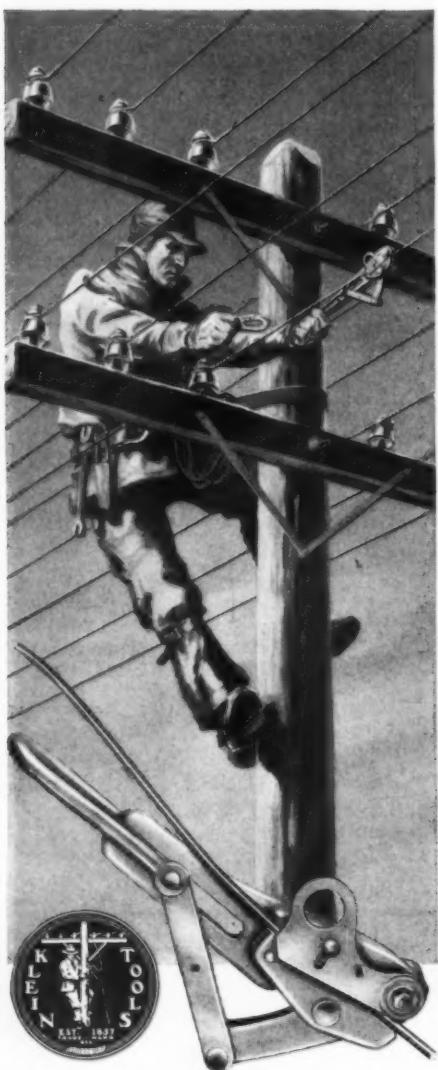
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Reader's QUIZ

[FROM PAGE 68]

phase transformers to feed welders and avoid the difficulty of balancing phases and to isolate welders from the regular power circuits? It is my idea to separate these welders from the regular power system.—R.C.P.

A. TO QUESTION 35. This power estimate involves factors based on two methods of determining ratings of welders. The total connected load, taking into consideration the instantaneous power capacity at the electrodes and the power output of the secondary, rated in kilowatts, is 585 kva. This represents the average of the two values, 501 kw. unity power factor total rating of the transformers, and 669 kva. .35 average power factor of about one-third of the total instantaneous maximum output.

Removing the welders from the secondary power-bus will result in less disturbances in the bus and its apparatus if the transformers supplying it are at present overloaded. In addition, if the primary service is adequate, more operating benefits will be gained by this change. This will compensate for the additional losses of the welder supply transformers. The rate of production determines, secondarily, the transformer capacity. With a very stable primary supply, it may be possible to feed the welders from one phase with one single-phase 600 kva. transformer. If the rate of production is moderate, one 400 kva. transformer may be satisfactory. This method is more practical than using a three to one phase transformation, because of the disadvantages involved in such a scheme. The losses in the three supply transformers (variable and constant) would be high, in proportion to their rating, and the power will not be balanced.

It may be advantageous to use three 200 kva. single phase transformers with similar characteristics to the existing ones. This will allow a parallel connection to be made with the system in case of future demand. The welders may be staggered on three phases.—O.A.

A. TO QUESTION 35. Some time ago we purchased welders with a total capacity of 1100 kva. These were all connected to one 500 kva. single phase transformer upon the manufacturers recommendation. When we started welding, the voltage drop was so great on the primary that all the lights in a neighboring plant went out. These were mercury vapor lights and this was very serious as it required several

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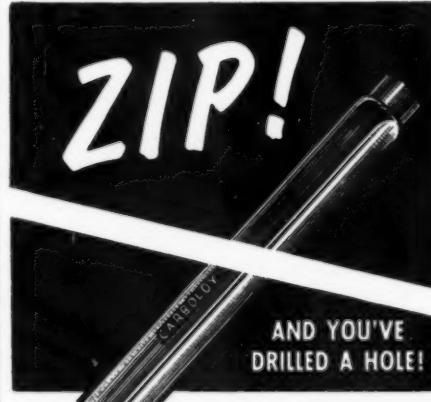
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minutes cooling time before they could be relighted. As a result, we purchased two more 500 kva. transformers and connected them 3 phase delta with the welders balanced on the phases. The transformers are tapped for 480 volts and drop to 450 volts under load. We have had no trouble whatsoever since, so my suggestion is to purchase three 200 kva. transformers, connect them 3 phase and balance the welders on the phases.—C.E.S.

A. TO QUESTION 35. Depending on the location of spot welders, if the smaller units are in a compact location I suggest using 1-75 kw., 440-volt secondary transformer for the units up to 25 kw.

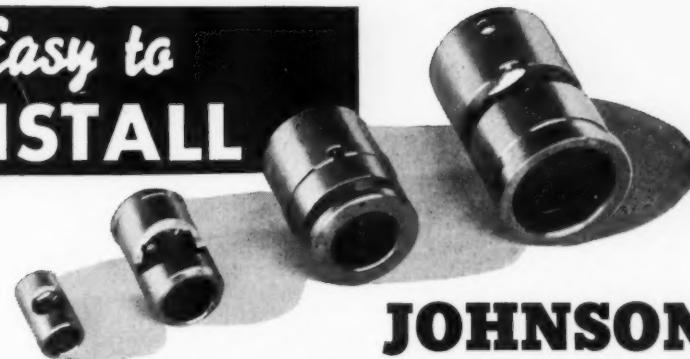
For the larger units use 1-150 kw. 440-volt secondary transformer. The cost and amount of wire necessary to isolate the spot welders should be your deciding factor, on whether you should split your load, or centralize on one large unit, using a special color insulation for your spot welding power lines.—W.H.L.

A. TO QUESTION 35. The transformer capacity required to supply this load of resistance welders would depend upon the duty cycles of the various machines, and the capacity installed would have to be sufficient for the equivalent continuous load. For spot welders, this equivalent continuous load runs about 5 to 10 per cent for most installations and occasionally from 10 to 20 per cent of the sum of the nameplate ratings. On this basis, a transformer of 15 per cent of the sum of the machines to be supplied (501.5 kva.) or 75 kva. should be adequate. However, with the heaviest unit rated at 150 kva., a bank of this same rating (150 kva.) might be considered necessary, especially if the operating cycle were uncertain. With 12 welders, it can be said that two might operate simultaneously, but that there would be only a remote chance of three units being operated at the same instant.

Voltage drop would be an important consideration. We are dealing with heavy currents of power factors of from 20 to 40 per cent and because of this, it might be necessary to use a standard transformer larger than 150 kva., or else a special one having low impedance. This voltage drop consideration might also make it necessary to locate the transformer as close to the welders as possible. A general rule for a good workable installation is that the voltage drop from the power station to the largest welder should not exceed 10 per cent.

On the question of whether to use single or three phase transformers, one single phase transformer would be desirable because thereby all transformer

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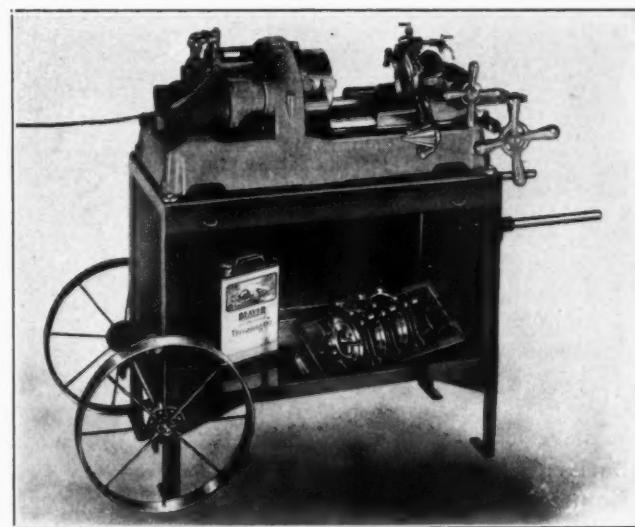
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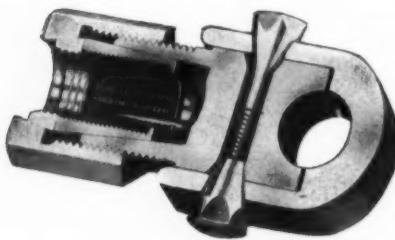
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Reader's QUIZ

[FROM PAGE 71]

capacity would be in that one unit and so the transformer voltage drop would be less than if the transformer capacity were to be divided across three phases. Whether to use single or three phase transformers would depend upon the ratio of welding kva. to total plant kva. If the welding load is small, single phase operation should be satisfactory.

In any case, look out for lightning voltage disturbances.—J.M.T.

CHANGING PHASE

QUESTION 36. A traveling cleaner uses a one hp. capacitor blower motor and a $\frac{1}{4}$ hp. traction motor (repulsion-induction). The tendency is to change this over to 3 phase. This is a simple matter on the capacitor motor but what about the $\frac{1}{4}$ hp. RI motor? It is a gearhead motor and is impractical to use a motor of a different frame. —T.L.T.

A. TO QUESTION 36. If the supply is substantial, one phase may be used to run the motor. These motors are universally constructed to operate on either a lighting or power circuit by merely changing the external connections of the primary. On a standard power circuit the 3 phase motor should draw 3.4 amperes per line. The RI motor operating on one phase should draw 2.5 amperes per line. Both motors are assumed to operate at reasonable power factor. Under this condition, brief vector calculations show that the 3 phase supply leads will carry 3.4—5.5 amperes respectively.

It is obvious that, if the source of supply is stable, the small amount of unbalance in the distribution system will not interfere with satisfactory operation. It is advisable to start the 3 phase motor first. Portable power equipment generally requires a ground lead, but it is inadvisable to operate the RI on this conductor because: (1) It is a violation. (2) The total current unbalance would be greater, concentrated on one phase only.—O.A.

A. TO QUESTION 36. If it is possible to rewind the stator of your $\frac{1}{4}$ horsepower RI motor for 3 phase (some single phase stators have a solid lamination in the center of each pole) I would suggest that you wind five or six turns of bare copper, 16 gage or thereabouts, around the commutator and solder to the bars. This makes a

squirrel cage out of the armature winding and works out very satisfactorily as a rotor on a 3 phase line.—M.H.

A. TO QUESTION 36. Assuming that the motors are rated at 220 volts, you can change your blower motor as you had planned. The traction motor may be fed from any two wires of a 3 phase line. Leave the $\frac{1}{4}$ hp. motor connected as it was originally, the changes being made in the method of feeding the control.

If both motors run at the same time and conditions permit, tap in at the 1 hp. motor leads for a feed for the $\frac{1}{4}$ hp. motor. It will be necessary to insert some sort of thermal protection if the present control is eliminated and the main control should be set to carry the additional load.—A.W.B.

Can You ANSWER these QUESTIONS?

QUESTION N1.—In maintaining a 1500 amp., 20 volt generator driven by a 40 hp. synchronous motor and with a load of 500 amperes, it is necessary to take off the brushes every day to remove copper, which I think is picked up by an electrolytic action from the commutator.

The machine is 6 pole and has a double commutator with 116 brushes. Several grades of carbon have been tried with no better results. Can any one suggest a remedy for this condition?—F.U.

QUESTION 01.—What is the effect on the performance of a 3 phase, 60 cycle, 440-volt induction motor if the stator is turned end for end or rotated 90 deg. or 180 deg.? —H.D.M.

QUESTION P1.—We would like to use a 3-phase, 60-cycle generator as a synchronous motor for power factor correction. After the motor has been brought up to synchronous speed by a smaller motor, should the field switch be closed first or should the 3-phase current be applied to the stator first?—J.J.L.

QUESTION Q1.—Given a combination load with 150 kva. at .8 power factor on 3 phase and 100 kva. at 1.0 power factor on single phase, what is the division of the load between transformers when supplied from:

(a) 1—200 kva., and 1—100 kva., 4000/2300 volt primary connected open Y to 230 volts open delta secondary.

(b) 1—200 kva. and 2—100 kva., connected Y to delta.

What will be the effect on the operation of this bank if the Y neutral is grounded or not grounded?—R.L.M.

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Double break, silver alloy contacts do away with all contact maintenance. No more filing—cleaning—dressing of contacts. You install an A-B solenoid starter and forget it! It's good for millions of operations.



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A-B sheet metal cabinets are now treated with the Bonderizing Process which provides a rust-resisting undercoat for the baked enamel finish. The adhesion and durability of the enamel surface is thereby tremendously increased—especially under bad moisture conditions. Infra-red lamp ovens are used for the final baking operations.



Made in
5 Sizes
up to
50 Hp, 220 V
100 Hp, 600 V

The Allen-Bradley Family of ACROSS-THE-LINE SOLENOID STARTERS

Did you ever see a finer looking family of motor starters? And such simple design! From smallest to biggest they are alike in attractive appearance, which makes them mighty popular with machinery builders.

With only one moving part...with

double break, silver alloy contacts . . . with precision overload relays, this family of solenoid starters is leading the parade with a new standard of motor control performance.

Let us send you the "Story of the Solenoid Starter."

Allen-Bradley Company, 1329 S. First St., Milwaukee, Wis.

STANDARD ENCLOSURES FOR EVERY SERVICE



For general installations



For corrosion-proof service



For water-tight service



For non-hazardous dusts



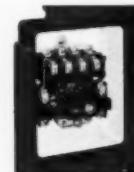
For non-corrosive hazardous gases



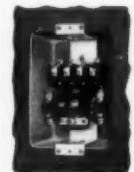
For corrosive hazardous gases



For hazardous dusts



For wall mounting



For pedestal mounting



ALLEN-BRADLEY SOLENOID MOTOR CONTROL

QUALITY

**Our Job
In '42**

[FROM PAGE 20]

cent housing, it is likely that this is one field where restrictions will be relaxed. In wiring we may expect more emphasis on non-metallic sheath cable systems and extensive use of porcelain or other non-metallic outlet boxes and wiring devices.

9. New demands for wiring and electrical equipment are appearing in mines and the petroleum industry. Many marginal producers are opening up mining properties normally dormant to full time operation. Electric power, lighting and signalling systems must be repaired and restored to good working order.

10. The pressure of 24-hour operation at full capacity is accelerating depreciation in electrical equipment in industrial plants. There is, consequently, more interest than ever before in preventive maintenance and ready repair facilities to hold production schedules. It is safe to estimate a new high in 1942 for skilled electrical maintenance and repairs.

It is a big job. What is being done, what can be done, to bring the full organized strength of the electrical construction industry to the efficiency and effectiveness that war demands? There are several schemes which combine the forces of groups of contractors to pool resources, tools and skill. Unfortunately, the obvious advantages of cooperative ventures run squarely against the anti-trust laws. In spite of the high motives and the good common sense which have backed the cooperative efforts of a few contractors around the country, each venture has required highly skilled and experienced legal counsel and frequently awkward corporate or partnership structures and job procedure to avoid technical violations of the law. In recent weeks, however, OPM advised that to protect legitimate groups against trouble under the anti-trust laws, J. L. O'Brien, General Counsel of OPM and Attorney-General Francis Biddle will pass on proposed groups or pooling plans in advance.

Under present policy, OPM announces that clearance will be limited to the following general cases:—

1. An association representing units in a given community or industry organized by the members themselves or by a non-profit agency.

2. An association representing units

in a given community or industry organized by a concern equipped with physical facilities for participation in the performance of defense contracts or equipped to provide substantial services in connection the performance of such contracts by other members.

Application for permission to form cooperative ventures may be directed to regional OPM offices.

Two cooperative schemes for electrical contractors offer excellent working arrangements, preserve the business identity of the cooperating firms and come within the limits of OPM's general cases above.

1. The "joint venture" under which several firms pool resources on an even or proportional basis for handling specific contracts. A notable example was described in detail in the October issue of *Electrical Contracting*.

2. The so-called "mother hen" plan under which a leading contractor gathers a group of smaller concerns into his orbit. The parent concern solicits, contracts for the business and handles the work, delegating portions of the job to the member contractors.

Under war time rules, contracts may be let without competitive bids; consequently facilities for handling the work in the shortest time will determine who gets the job. Under existing conditions individual facilities can be expanded only by forming cooperative groups.

Critical shortage in skilled supervisory personnel can be expected as the draft and government departments reach into shops and offices for experienced men. The available supply of skilled mechanics has been bolstered by farm wiremen and apprentices. Many house wiremen and small contractors have taken in their shingles for the duration to take jobs on war plant construction. Further extension of the work week will provide more man hours of productivity from the present labor supply, but the situation is still critical and will, in all probability, get worse as war construction speeds up. It will take skillful management and competent supervision to keep the labor working to the best advantage.

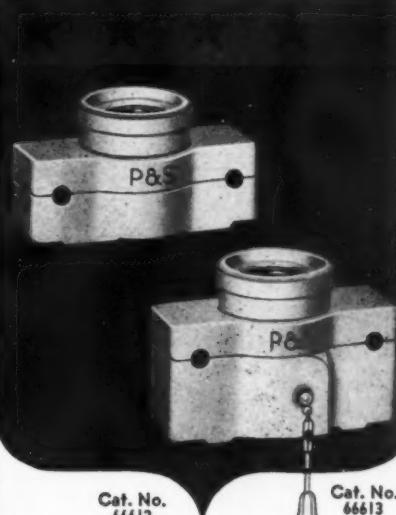
For individual contractors the future, in many instances, is uncertain. Firms geared to commercial work, without contacts in industry, are already suffering from material shortage and curtailed markets. The management skill and facilities of these concerns must be brought into essential service through industry planning.

For the industry as a whole the future holds the biggest and the toughest job we ever tackled.

P&S

WIRING DEVICES

**for
NATIONAL
DEFENSE**



NEW... Pull and Keyless Porcelain Cleat Receptacles. Designed for the Defense Market.

Send for your copy of our new "Defense Catalog"—a brief summary of the P&S Wiring Device Line which provides a handy reference for selecting materials for construction, repair and maintenance under the Defense Program.

**Sold Through
Electrical Wholesalers**

**Pass & Seymour, Inc.
SYRACUSE, N. Y.**

Modern Lighting

OUTSTANDING LIGHTING

It hasn't been so many years since the electrical contractor was selling 10 foot-candle installations and rightly proud of the jobs when they were in-



APPLIANCE LIGHTING of the 83 foot-candle variety provides that extra punch that makes selling easy. The appliances here are bathed in high intensity illumination.

stalled. With the advent of the fluorescent lamp, however, new vistas have been opened and the 10 foot-candle jobs of yesterday are giving way to the 50 foot-candle jobs of today. It's real news, however, when an installation is made that provides 83 foot-candles in service. The Rex Cole installation is such a one. There are two rows of 100-watt mazda F lamps in Ainsworth "Fluor-O-Spine" units. The units are six feet apart and mounted about 17 feet above the floor.

FLUORESCENTS IN A TURF CLUB LOUNGE

Fluorescent lamps in new fluted translucent glass fixtures grace the lounge, bars and club areas to help make the swank Golden Gate Turf Club at Albany, Calif., what the club officials believe, "the best lighted horse racing establishment in the world."

A total of 97 Westinghouse flu-

rescent units, each containing two 40-watt lamps, together with 40 other one-lamp units, provide soft, even glare-free light in the exclusive Turf and Paddock Club, the club house, lounges, dining rooms and promenades. These are all located in the 850-foot three-tiered one-unit building which houses almost all facilities of the club.

Lighting in the circular lounge of the Turf and Paddock Club is provided by 13 two-lamp fluorescent units mounted on beams radiating from a center pillar which is topped by eight one-lamp fluorescent units. This combination produces an average of five foot-candles on a horizontal plane, 36 inches above the floor.

INDIRECT FLUORESCENT

Because today's work, for the most part, is done indoors and at close range, it is necessary that adequate amounts of lighting of the proper quality be provided for most effective operation. In the past, high quality lighting has been provided by means of indirect filament



EYE-COMFORT LIGHTING is provided in this office by rows of suspended indirect fluorescent troughs. Close spacing presents louvered effect and cuts down ceiling brightness.

equipment and more recently by direct and semi-direct fluorescent equipment.

The most recent step in providing high quality lighting is the use of fluorescent lamps in indirect equipment. The installation pictured is in the offices of the Illinois-Iowa Power Company, Decatur, Illinois. It consists of continuous rows suspended indirect troughs. The units are on 5-foot centers and equipped with two rows of 40-watt mazda F white lamps and provide 50 foot-candles of general illumination. Because of the close spacing of the equipment, a louvered effect results which cuts down on any objectionable ceiling brightness.

HIGH BAY FLUORESCENT LIGHTING

The fluorescent lamp makes its debut as a high bay illuminant in the recently erected Curtiss-Wright plant at Buffalo, N. Y.



RADIAL MOUNTING of enclosed fluorescent units together with horizontal ones on a center column provide soft, evenly diffused, glare-free light in this lounge.



ON the front line of Victory, light makes right — 24 hours a day! Seeing better means doing better! And, that's where Day-Brite Fixtures help — they utilize the higher efficiency of fluorescent lighting ... Backed by 18 years' specialized lighting experience, they are designed and engineered to lessen eye fatigue and assure the clearer vision necessary for greater accuracy, closer tolerances, quantity output and fewer rejects ... DAY-BRITE IS THE LIGHT LINE OF VICTORY! ... Consult Day-Brite Engineering Representatives, located in principal cities ... Nationally distributed through all Leading Electrical Supply Houses.

DAY-BRITE LIGHTING, INC., 5433 Bulwer Ave., St. Louis, Mo.

Whatever you need in Fluorescent Fixtures is available in the Complete Day-Brite Line! A large, modern plant geared to high-speed, accurate, quantity production every step of the way. Send for catalogs.



THE COMPLETE LINE
OF FLUORESCENT
LIGHTING FIXTURES







ENGINEERED SEEING Goes to Work for America

Here's Westinghouse *engineered seeing* doing a 24-hour-a-day job in one of our nation's largest aircraft plants. Eleven thousand two hundred sixty fixtures, providing 35 footcandles of glareless light, assure quick, accurate vision for every man at every machine.

In this main factory bay, reflectors are mounted 18 feet high and each is equipped with two 100-watt fluorescent lamps. In all, there are 17,586 Westinghouse fixtures in the complete system of lighting for indoor production and outdoor protection.

Today in Cleveland our Lighting Division stands ready to supply lighting equipment for practically every phase of American war industry. You may obtain full information on this equipment from any of your 117 Westinghouse Electric Supply Company offices or independent Westinghouse lighting distributors.



Westinghouse

LIGHTING EQUIPMENT



*Modern
Lighting*

[FROM PAGE 76]

Past practice has been to use concentrating equipment with either filament lamps or mercury lamps. However, in airplane assembly plants the high bay areas are extremely large, the main area here being 400 by 600 feet. This, coupled with the fact that the tasks which are performed in these locations are severe, makes fluorescent lighting a natural.

This high bay installation consists of 2200 twin lamp RF units. They are



REDUCED GLARE and lower brightness of the high bay, type RF, fluorescent lighting in this plane assembly plant, eliminates eye fatigue among mechanics.

placed on 11-foot centers, 42 feet above the floor, and provide approximately 30 foot-candles in service.

With this type of lighting, reflected glare from the polished surfaces is reduced. Also, the brightness of these large-area sources would not be nearly so objectionable as the brightness of filament or mercury sources. This fact is worth noting because the workmen frequently look at the ceiling in the assembly of wings, motors and other plane parts.

NARROW STORE LIGHTING

Effective illumination of the long narrow store occupied by Pfaff's Mens' Store, Oberlin, Ohio, was accomplished by using a long line of fluorescent units down the center of the store.

General lighting of the 84-ft. by 18-ft. store area is provided by 21 Curtis SkyLux units mounted end-to-end down the center of the store on the 11-ft., 6-inch ceiling. Each unit contains two 40-watt daylight fluorescent lamps. The total wattage of 2,000, including bal-

FOR YOUR PROTECTION . . .

Fluorescent Ballasts built to rigid standards and tested for compliance with the high qualifications established by the Underwriters and the Electrical Testing Laboratories, are your best assurance for long life, trouble free installations, and satisfied customers.

Insist that all Fluorescent Ballasts you install bear the three seals that stand for dependable performance—**UL** for Safety; **ETL** for Operating Standards; **QC** for Quality. Chicago Transformer Fluorescent Ballasts are designed to more than meet established standards, built under an exacting control system for uniformity and subjected to constant tests to assure maximum lighting efficiency.



**CHICAGO TRANSFORMER
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3505 WEST ADDISON STREET • CHICAGO

76]

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WHETHER YOU ARE
Wiring
OR
Rewiring



Typical installation of Wiremold for lighting and utility circuits in an industrial building.

● There are many advantages in having your wiring circuits ON THE SURFACE. Wiremold Surface Metal Raceway Systems can be extended or relocated quickly, at low cost. New circuits can be added or changes made in the location of outlets, switches, etc. without breaking into plaster or "fishing" old conduits.

Furthermore, wiring that is enclosed in strong, safe Wiremold Surface Metal Raceways is always readily inspectable, less subject to unnoticed deterioration, completely protected. Wiremold Raceways meet all Code and Underwriters' requirements yet their compact, thin wall construction conserves steel.

These are some of the reasons why architects, electrical contractors and plant or building managers now favor Wiremold Wiring Systems for initial wiring installations in new factory, school, office, and commercial buildings. Wiring or re-wiring, Wiremold does a better job in the first place and lays the foundation for further economies through the years.

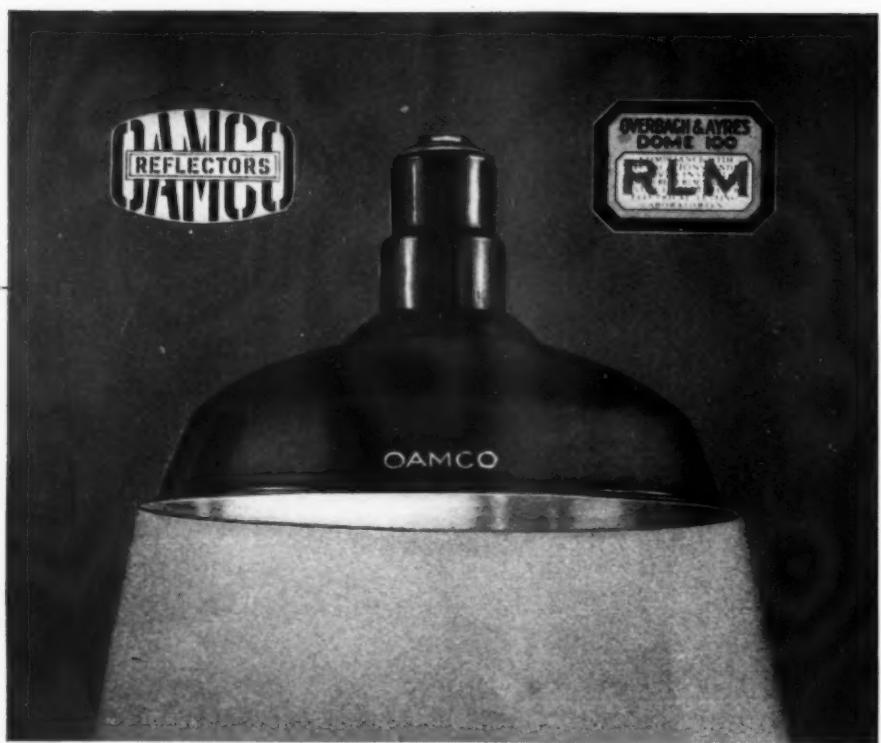
Catalog and Wiring Guide on request.

with **WIREMOLD**
SURFACE METAL RACEWAY
WIRING SYSTEMS

THE WIREMOLD COMPANY
HARTFORD, CONN.



BETTER LIGHTING must start with BETTER WIRING



*Modern
Lighting*

[FROM PAGE 80]

lasts, gives an average of $1\frac{1}{3}$ watts per square foot of store area. The resultant average foot-candle intensity is 45 in the



LINE OF LIGHT down the center of this long narrow store provides 30-45 foot-candles of cool fluorescent daylight on the merchandise displayed.

center of the room and 30 at the sides. Recessed wall display niches are lighted by flush type units mounted in the ceiling of each niche.

APPROVED INCANDESCENT LIGHTING

The OAMCO line includes every size, style and type of reflector for industrial and commercial use. Whatever your requirements are, you will find OAMCO reflectors engineered to do the job perfectly—designed for maximum lighting efficiency—manufactured for long years of service. OAMCO reflectors are approved by the Electrical Testing Laboratories and are in accordance with the RLM Standards Institute's specifications. Send today for our catalog showing the complete OAMCO line.



FLUORESCENT

Overbagh & Ayres' forty years of lighting equipment experience contributed greatly to the development of OAMCO fluorescent reflectors. These fixtures embrace features not found in ordinary equipment.

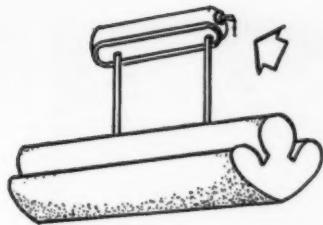
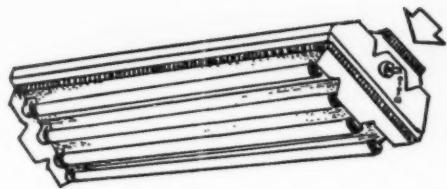
RIGHT LIGHT SINCE 1902

OVERBAGH & AYRES MFG. CO.

MEMBER OF THE RLM STANDARDS INSTITUTE
411 SOUTH CLINTON STREET • CHICAGO



FLUORESCENT AND INCANDESCENT lighting combine to create a cheerful atmosphere with dramatic merchandise displays in this New York greeting card shop.



McGILL *Levolier* Switches

Designed for Trouble-Free Fluorescent Operation

Only the best switches are worthy of consideration in fluorescent lighting installations. McGILL Levolier switches are designed to meet the most exacting specifications found in fluorescent lighting problems. Protect

yourself against replacement of switches, which is costly and troublesome, by installing McGILL Levolier switches. Their dependability is assured by many years' experience in practically all types of installations.

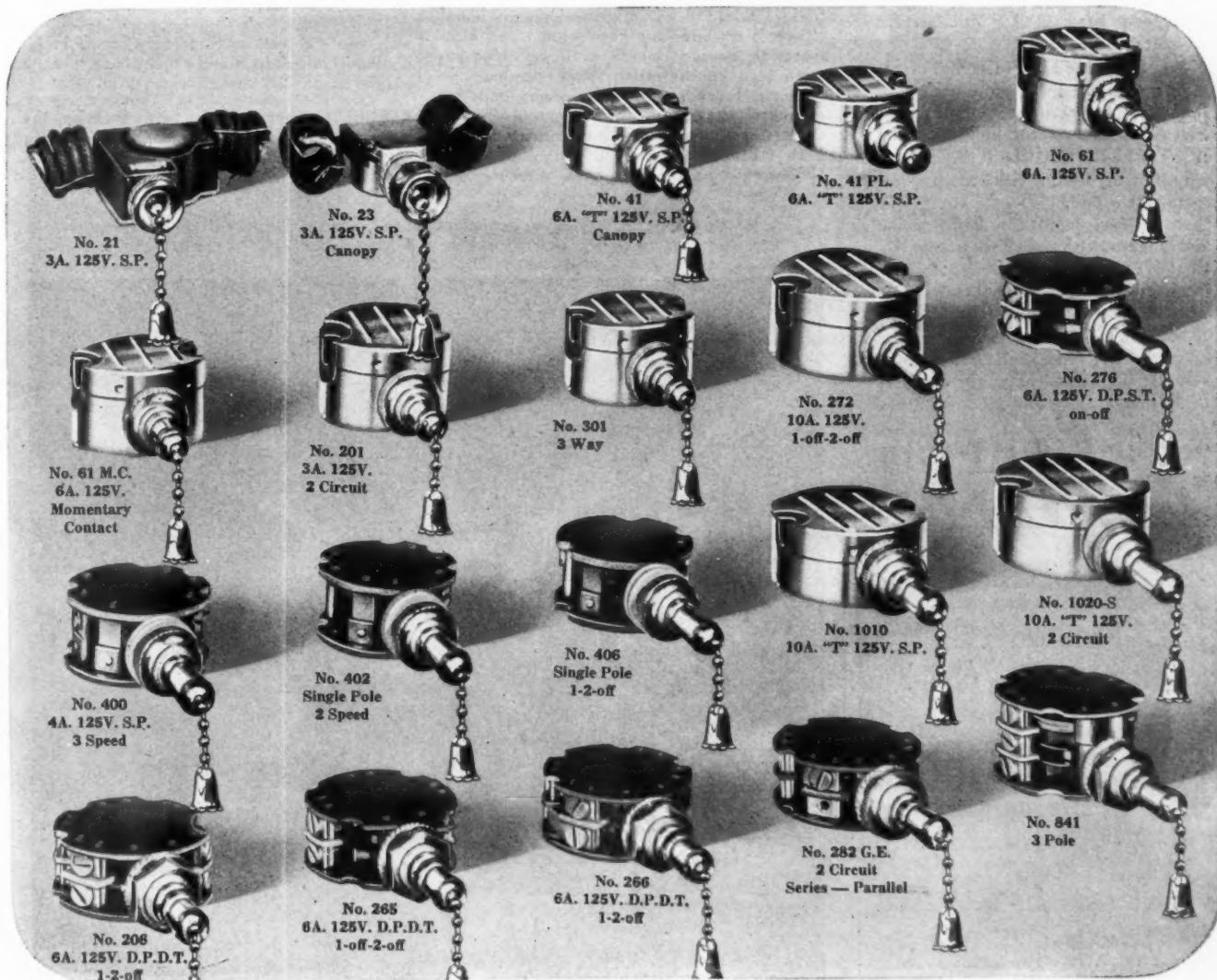
Levolier Switches in Today's Fluorescent Units

No.	Amp.	Volt	Control
39	6-A	125-V	link type, on and off
41	6-A	125-V	on and off
1010	10-A	125-V	on and off
276	6-A	125-V	on and off, double pole
1020	10-A	125-V	lights any two tubes, or all four and off
1029	10-A	125-V	link type, lights any two tubes, or all four, and off
1039	10-A	125-V	link type, on and off

McGILL Levoller Switches — Recommended by many Leaders in the Fluorescent Lighting Field, some of which are listed below:

Goodrich Electric Company, Chicago, Illinois
Garden City Plating and Mfg. Company, Chicago, Illinois
Art Metal Company, Cleveland, Ohio
DayBrite Lighting, Inc., St. Louis, Missouri
Benjamin Electric Mfg. Company, Desplaines, Illinois
Edwin F. Guth Company, St. Louis, Missouri
F. W. Wakefield Brass Company, Vermilion, Ohio
Hygrade Sylvania Corporation, New York City, N. Y.
Wheeler Reflector Company, Boston, Massachusetts
Curtis Lighting, Inc., Chicago, Illinois

McGILL MANUFACTURING COMPANY • Electrical Division • Valparaiso, Indiana





Modern Lighting

[FROM PAGE 82]

tion Division of Amos Parish & Co., Inc., New York. The electrical fixtures used in the installation were built from their special designs by Kurt Versen, Inc., also of New York. Here the two methods of lighting supplement each other to create an atmosphere of sunny

cheerfulness and to display the merchandise with dramatic interest.

Nu-white fluorescent tubes are installed in an overhead cove, flanked by six built-in coffers with incandescent lamps, which act as a color-corrector to the clear white light.

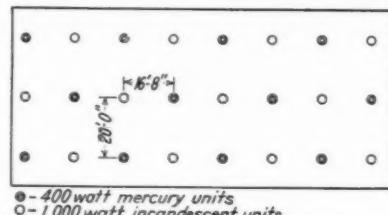
This combination is also used in the various display units, planned for dramatic color effects painted with light. In the model display windows, regular G.E. spot and flood lamps with special glass color clips are supplemented with colored fluorescent lamps.

Lighting a HIGH BAY BUILDING

PROBLEM—To provide adequate illumination of the proper type to facilitate the performance of work in an assembly area.

CONSTRUCTION DATA—The area occupied is 600 feet long by 60 feet wide with a large monitor skylight above the roof trusses. All structural members are of steel. The distance from the bottom of the trusses to the floor is 45 feet. The ceiling, upper walls and structural members are painted white; the lower walls, dark green.

SOLUTION OF PROBLEM—General illumination is provided by incandescent and high-intensity mercury lamps in direct high-bay open type concentrating Alzak aluminum reflectors. Incandescent and mercury units are alternately staggered on 20-foot by 16-ft. 8-in. centers and mounted 44 feet above the floor. Each incandescent unit is equipped with a 1000-watt bipost lamp; each mercury unit



PLAN VIEW of typical bays showing the staggered arrangement and spacing of the incandescent and mercury lighting units.

with two 400-watt H-I mercury lamps in individual reflectors, and operated through auxiliaries on 230 volts.

RESULTS—After three months operation, the average illumination intensity on the working plane three feet above the floor was 42 foot-candles.

COMBINATION LIGHTING with incandescent and mercury units provides high-intensity illumination in the transformer coil department of this manufacturing plant



"DO IT RIGHT WITH LINOLITE"

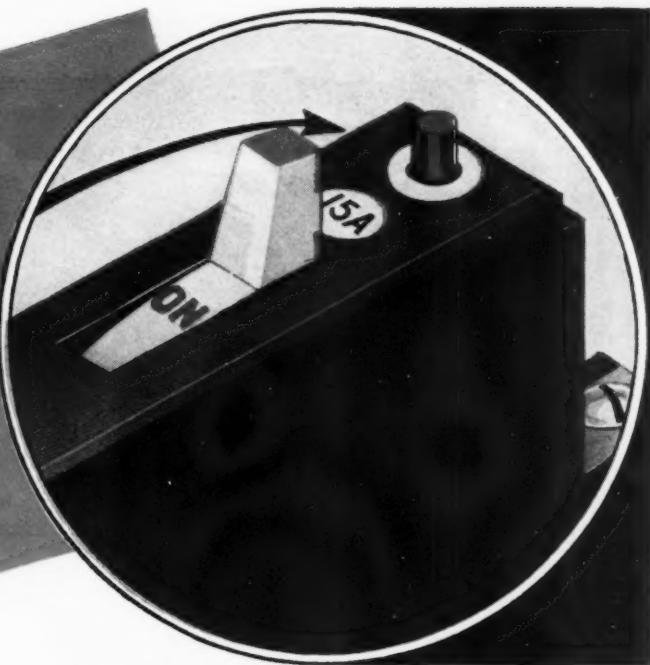
The FRINK Corporation
and subsidiaries
Barkon-Frink Tube Lighting Corp.
Sterling Bronze Company

THE FRINK CORP.
Bridge Plaza South,
Long Island City, N. Y.

Please send me your new brochure on "The Ultimate in Fluorescent Lighting."

NAME _____
ADDRESS _____
CITY _____ EC

**When tripped—
red button
protrudes**



You can see at a glance which circuit has been affected. Even in the dark you can ascertain where the trouble lies — the projecting button tells the story . . . This is but one of the many features which have gained favor for



Dublbrak Circuit Breaker **PANELBOARDS**

Protection against harmful overloads is assured — and, due to proper time lag characteristics, annoying interruptions of service, from short circuit or momentary overloads, are prevented.

- ★ There are only two positions of the handle — ON and OFF. *There is no intermediate position.*
- ★ Contacts are double-break, to provide low arcing . . . quick make and quick break for manual action, and quick break on automatic operation from sustained overload or short circuit.
- ★ Main bus bars are made of 98% pure hard-drawn copper, and direct copper-to-copper contact is made to circuit breakers.
- ★ The binding screws cannot be removed. Corrugations in the neutral connection plate prevent wires from turning when the screws are tightened.
- ★ Each [®] Dublbrak Circuit Breaker is equipped with [®] wire terminal connectors of the clamp contact type. The wire is inserted into a flared opening, and fastening screw tightened. *No washers or other parts are needed.*
- ★ Boxes are of code thickness steel, with knockouts to meet every requirement . . . 4-inch gutters make connecting easy.
- ★ Fronts are borderized to prevent rusting, then finished in pearl gray lacquer. They are equipped with [®] front fastening device, for ease in centering and plumbing.
- ★ Panelboards from 2 to 42 circuits are assembled from standardized units.

Capacities: 15, 20, 25, 35 and 50 amperes, 125 volts, single pole; or 250 volts, double pole, individual trip, AC or DC.

Let us suggest — "Ask the [®] Man!"

[®] Sales-Engineers are located in many principal cities. More than likely their long experience can be of real service to you. They welcome the opportunity to serve Architects, Engineers and Contractors. Write for name and address of the one nearest you — or see listing in Sweet's Catalog, Electrical Buyers' Reference or Thomas' Register . . . And ask us for Bulletin 57 . . . Frank Adam Electric Company, St. Louis, Mo.

[®] Dublbrak Circuit Breaker Panel board and Cabinet, with main lugs only. (Catalog No. NA1B24-3L100).

[®] Dublbrak Circuit Breaker Panel board and Cabinet, with main breaker. (Catalog No. NA1B12-3AB100).



Estimating

LOOSE-LEAF JOB LAYOUTS

Electrical contractors are quite often invited to bid on electrical work for which no plans or specifications have been developed. Good engineering and estimating practice demands that the contractor submit with his proposal at least a plan showing just what he intends to do. Since most of these jobs are of the smaller type, or the work is needed in a hurry, detailed specifications as to materials are not made. In most cases it is a question of the customer calling up and giving a verbal description of what he wants done.

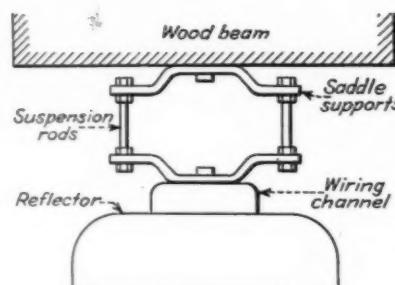
The E. J. White Company, electrical contractors of Newark, N. J., makes a sketch of the proposed layout for jobs of this type. The sketches are drawn on 11-in. by 16-in. sheets of quadrilled graph paper of the semi-transparent type. Blue prints of the layout can then be made to submit with the proposal or to give to the job superintendent in case they are awarded the contract. The original sketch is filed in a loose-leaf binder with similar ones of other jobs.

This method can also be used for making detailed sketches of parts of larger jobs, when desired. In this case, all sketches pertaining to one contract can be filed in a binder reserved for that particular job. Its just another method for the estimator to keep important information at his finger tips.

CONTINUOUS ROW FLUORESCENT LIGHTING

The Connecticut Tool and Engineering Company, Bridgeport, Conn., recently took over an existing building and remodeled it to take care of their defense business.

Because they make tools and gauges, the work requires precision and exceptionally good lighting. Illumination is provided by four parallel rows of suspended continuous Miller two-lamp, flu-



SUSPENSION detail for continuous fluorescent trough units

orescent, closed end units, totaling 336 feet. The fixtures, in general, were mounted in 8-ft. sections suspended 9-ft. above the finished floor. These sections were bolted together to form a continuous trough.

The method of suspension consists of a set of saddle supports, the upper one bolted to the wood beam, the lower one to the fixture wiring channel. Lag screws were used in the beams. Two 14-in. bolt rods separated the saddle supports. These suspension units were installed on approximately eight foot centers.

The electrical contractor made the installation in progressive steps, first installing the supports, then mounting the wiring channel, next installing the lamp auxiliaries and finally mounting the reflectors, lamp starters and lamps. All work was done by a two-man crew working from a 6-ft. scaffold.

The following labor breakdown was kept by the contractor for future reference.

INSTALLING SUPPORTS—includes mounting the saddle supports, cutting, threading and installing the two 14-in. bolt rods for each suspension unit. Two men were used.
Avg. time per support.....0.167 m.h.

MOUNTING WIRING CHANNEL—includes mounting the fixture wiring trough to the supports, leveling same and bolting the 8-ft. sections together to form the continuous trough. Two men were used.
Avg. time per 8-ft. section.....0.667 m.h.

WIRING AND CONNECTIONS—includes all wiring and connections and the installation

of the lamp auxiliary units. Two men were used.

Avg. time per 4-ft. unit.....0.5 m.h.

MOUNTING REFLECTORS AND LAMPS—includes the installation of one reflector, two lamp starters and two lamps per four-foot unit. Two men were used.

Avg. time per 4-ft. fixture.....0.5 m.h.

The above data is presented only as a guide for similar installations. Individual job conditions may vary and hence must be taken into consideration.

*Data from Raymond F. Walsh,
Bridgeport, Conn.*

ESTIMATING SUPPORT COSTS

* Much of the labor and a significant portion of the material cost for exposed conduit on tubing work appears under the general category of hangers and supports. As specification and installation conditions differ widely for the many varieties of exposed installations, estimators generally have adopted the practice of applying standard conduit labor units to exposed wiring covering the actual pipe work only and listing and pricing supports or hangers separately. This method provides a more precise and accurate take-off and automatically adapts to variation in specifications or installation conditions.

To take off feeder hangers, they may be indicated best on a scale layout. Where there are a number of heavy conduits, the plans will usually show the runs. On exposed branch circuit work, making actual layouts with each hanger or support marked would be much too tedious and time consuming for the estimator. An approximation made by dividing the total amount of conduit by the specified distance between fastenings plus the outlet fastenings will give a sufficiently accurate estimate of the number of supports.

For convenience in pricing supports and hangers the accompanying tables show both material and labor units for each size and type in several applications. The material prices should be carefully checked by the estimator and adjusted to his favorite brand of anchor and his local prices. Those given represent approximate costs to the contractor for normal quantities in the Chicago area. Labor units are average net labor hours based upon hand drilling in concrete and electric drills on steel. A reduction in the labor units when power hammers are used will depend upon the number of fastenings and the setting up required.

BOX MOUNTING DEVICES



Ideal for modern, efficient Surface Wiring
IN INDUSTRY OR IN THE HOME

Durability and long life in everyday service are built into all types of Bryant Box Mounting Devices. Their high-quality and master workmanship assure complete satisfaction, whether installed in factories or in the home.

You choose the application. Bryant has the Box Mounting Device which we feel sure you will agree meets the need "right on the nose."

Metal Covers: Switches, Outlets and Lampholders for $3\frac{1}{4}$ " and 4" boxes. Covers are cadmium plated to resist corrosion.

All Porcelain: Lampholders only. Keyless and pull types with or without side outlet. Made with large diameter bases. $4\frac{1}{8}$ " diameter for $3\frac{1}{4}$ " boxes, $5\frac{1}{8}$ " diameter for 4" boxes.

Catalog will be sent to you on request. Write for your copy today. The Bryant Electric Company, Bridgeport, Conn.

Sold Through Electrical Wholesalers Nationally



EVERY OUTLET DESERVES A BRYANT DEVICE

BRYANT
SUPERIOR
WIRING DEVICES

When CABLE INSULATION Gets Wet

no harm is done if ANHYDREX deproteinized rubber insulation has been used. ANHYDREX has all the inherent value of rubber insulation — in fact

it is rubber insulation, but it will not absorb water and needs no protection from it.

Heretofore when cable insulations got wet every cable engineer knew that trouble was brewing — and it usually came. Water and insulation had to be kept apart or there was no service. Lead sheaths were for years considered a necessary part of submarine or underground rubber insulated cables. They were heavy and expensive but were the only effective available barrier against water.

Doesn't that give you an idea for saving money when you buy cables? We think it must. We will be glad to give you any data you may need to help you save money and get the best of service from ANHYDREX insulated power, control or signal cables.

SIMPLEX WIRE & CABLE CO.
79 Sidney Street, Cambridge, Mass.

FIND OUT ABOUT THE ADVANTAGES OF PYLETS · THE IMPROVED CONDUIT FITTINGS



Pylets offer you practical advantages designed for easier application, greater strength, and maximum security of wiring installations. Constantly growing use of this improved equipment in leading industrial plants where dependable service is paramount, reflects the value of the security and the time- and labor-saving features of Pyle-National fittings, plugs and receptacles, and other equipment. Investigate their advantages to you. Write for your copy of Pylet catalog 1100 with complete listings of all types.

THE PYLE-NATIONAL COMPANY
1344 North Kostner Avenue • Chicago, Illinois

Estimating

[FROM PAGE 86]

TABLE I
One Hole Strap Conduit Supports

Cond. Size	Concrete 1		Insert 2		Steel 3		Wood 4	
	Mat.	Lab.	Mat.	Lab.	Mat.	Lab.	Mat.	Lab.
1/2	.046	.17	.108	.14	.038	.16	.022	.04
5/8	.054	.17	.116	.14	.041	.16	.030	.04
1	.071	.20	.120	.15	.055	.18	.036	.05
1 1/4	.091	.20	.140	.15	.060	.18	.056	.05
1 1/2	.138	.25	.180	.16	.075	.23	.078	.06
2	.223	.25	.290	.16	.081	.23	.163	.06
2 1/2	.375	.30	.390	.17	.100	.28	.288	.07
3	.475	.30	.490	.17	...	...	.388	.08
3 1/2	.735	.40	.730	.20	...	...	.578	.09
4	1.01	.40	1.00	.20	...	...	.848	.10

1. Pipe strap, anchor and bolt
2. Pipe strap and T insert
3. Drill and tap steel, strap and bolts
4. Pipe strap and wood screws

TABLE II
Conduit Hangers

Cond. Size	Concrete 1		Insert 2		Steel 3		Wood 4	
	Mat.	Lab.	Mat.	Lab.	Mat.	Lab.	Mat.	Lab.
1/2	.36	.35	.39	.20	1.03	.15	.49	.20
5/8	.36	.35	.39	.20	1.03	.15	.49	.20
1	.36	.35	.39	.20	1.03	.15	.49	.20
1 1/4	.39	.35	.42	.20	1.11	.15	.52	.20
1 1/2	.40	.35	.43	.20	1.12	.15	.53	.20
2	.42	.35	.45	.20	1.14	.15	.55	.20
2 1/2	.52	.40	.55	.25	1.66	.20	.71	.25
3	.59	.40	.62	.25	1.73	.20	.78	.25
3 1/2	.72	.40	.81	.25	1.87	.20	.98	.25
4	.83	.50	.86	.30	1.93	.25	1.04	.30

1. Clevis, rod, anchor and misc.
2. Clevis, rod insert and misc.
3. Clamp, clevis, rod, coupling and misc.
4. Clevis, rod, U hanger and misc.

TABLE III
Miscellaneous Supports
Riser clamps, supporting vertical runs.

Conduit	Mat.	Lab.	Conduit	Mat.	Lab.
5/8	.28	.08	2	.33	.10
1	.29	.09	2 1/2	.35	.12
1 1/4	.31	.09	3	.36	.12
1 1/2	.32	.10	3 1/2	.45	.14

Saddle Hangers, including saddle, rods, U hangers, Hex nuts and screws.

	Wood		Concrete	
	Mat.	Lab.	Mat.	Lab.
For 6 1 inch conduits...	1.24	.40	1.54	.80
For 6 1 1/2 inch conduits...	1.47	.40	1.77	.80
For 8 1 1/2 inch conduits...	1.81	.40	2.11	.80
For 8 2 inch conduits...	2.40	.40	2.70	.80

	Mat.	Lab.
Messenger cable, 100 ft. 5/16 galv. cable, U supports, U bolt clamps, thimbles, turnbuckle, eye bolts.	4.96	1.81
Inserts.....	.09	.12
Pipe sleeve.....	.15	.20
Toggle in tile.....	.04	.12
Beam clamps.....	.30	.12

Data from A. J. Allyn, Chicago.

THE "BIG GUNS" OF DEFENSE

SPEED PRODUCTION

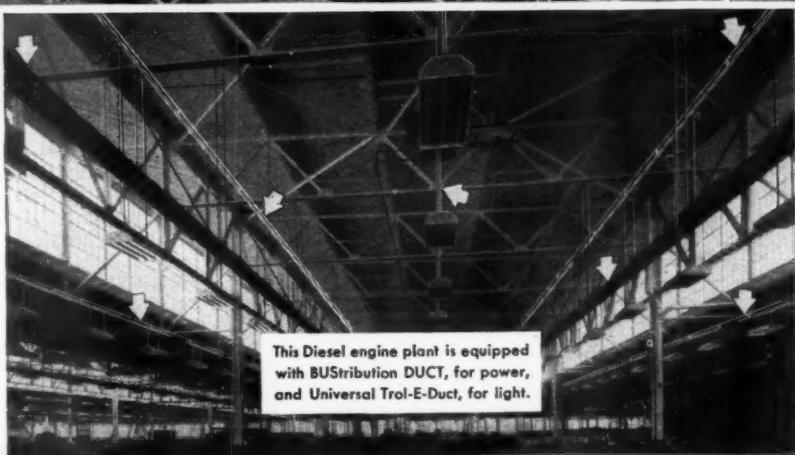
With BullDog "Plug-in" Electrical Distribution

DAY BY DAY more defense contractors — making everything from battleships to eyelets for shoes and from bombers to army shirts—are equipping their new plants, or modernizing their old, with BullDog Flexible Electrical Distribution Systems.

BullDog's "plug-in" Bus Duct systems are ideally suited to save precious production time for industry—to avoid wiring delays or delays in rearranging machinery and in planning new buildings. BullDog Bus Duct systems give ready light and power *anywhere*, permit "plug-ins" as simply as appliances in the home, and include various protective "plugs" for each individual machine.

There are three BullDog Systems — BullDog BUStribution Duct for Power; Universal Trol-E-Duct for Light, and Industrial Trol-E-Duct for Production Lines or Assembly Benches. They are used singly or in combination; are built in standardized, interchangeable sections; are quick and easy to install or to move from one position or one plant to another, and are completely salvable.

Write for Bulletins 403 and 412 describing these modern wiring systems. Better yet, ask for a call from a BullDog sales engineer — and ask him to show you the roster of hundreds of defense plants equipped with one, two or all three BullDog Systems.



MANUFACTURERS OF Vacu-Break Safety Switches, Circuit Master and SafeTface Panelboards, Switchboards, Bus Systems—FOR LIGHT AND POWER

Keep Up-to-Date on new developments

through this **FREE SERVICE**

Electrical Contracting brings you the latest literature of leading manufacturers without cost or obligation.

FLUORESCENT UNITS

1 Catalog Section FL-4 lists and describes the new glass-enclosed fluorescent lighting units and line-o-lamps. The Wiremold Co.

WIRING MATERIAL & POWER APPARATUS

2 Book No. 82-WP, 864 pages, of data on the proper selection of power apparatus and various types of wiring materials necessary for industrial, residential and outdoor wiring installations. Many tables from the National Electrical Code are included. General Electric Supply Corp.

MOTORS

3 Bulletin B6052-B describes this line of Lo-Maintenance motors in ratings from $\frac{3}{4}$ to 75 hp., open, enclosed and splash-proof types, a.c. and d.c. Allis-Chalmers Mfg. Co.

CONNECTOR AND CLIPS

4 Bulletin L2 illustrates and describes lugs and connectors for cable terminals and fuse clips and reducers for panelboard assemblies. Kolton Electric Mfg. Co.

OIL CIRCUIT BREAKERS

5 Bulletin B-6179 is a four page folder featuring Type DZ-40A oil circuit breakers. Allis-Chalmers Mfg. Co.

MOTORS

6 Bulletin GEA-3579 covers fractional horsepower motors for machine tools and other industrial applications. General Electric Co.

BLOWERS

7 A 64-page catalog and engineering data book on Universal blowers. It is profusely illustrated and uses of each type, characteristic curves, dimensions and performance data are included. Ilg Electric Ventilating Co.

TRANSFORMERS

8 Booklet B-2304 consists of 10 pages and gives answers to typi-

cal questions about air-cooled transformers, 150 to 2000 kva., for factories, mines and central stations. Westinghouse Electric & Mfg. Co.

CABLE POTHEADS

9 Bulletin 102 and supplement 102-A gives essential data and diagrams of construction features on cable terminating potheads. O. Z. Electrical Manufacturing Company.

TRANSFORMERS

10 Hipersil distribution transformers up to 500 kva. are described in bulletin B-2287, consisting of 22 pages. Westinghouse Electric & Manufacturing Co.

ELECTRICAL MACHINERY

11 Bulletin E100C is a 48 page "Catechism of Electrical Machinery". It gives the most important theoretical and practical features of the common types of d.c. and a.c. motors, generators and control equipment. Fairbanks, Morse & Co.

INFRA-RED

12 A folder illustrating and describing infra-red heating. It features pre-measured performance (temperature, time and operating cost). C. M. Hall Lamp Co.

OHM'S LAW CALCULATOR

13 This calculator gives answer to any Ohm's law problem with one setting of the slide. It has scales on both sides to cover range of currents, resistances, wattages and voltages used in industrial, electronic and radio fields. Ohmite Manufacturing Company.

SWITCHGEAR

14 Booklet B-2296, 25 pages, covers "unitized" low-voltage switchgear for use in central stations, industrial plants and commercial buildings. Westinghouse Electric & Mfg. Co.

SHEAVES

15 Bulletin B-6047 gives descriptions of Texsteel and Texdrive

sheaves for drives from fractional to 25 hp. Allis-Chalmers Mfg. Co.

WIRE AND CABLE

16 Catalog 59-104B illustrates and describes the Deltabeston line including power cables, switchboard wires, appliance wires, fixture wires and cords, magnet wires, etc. General Electric Co.

DISTRIBUTION SYSTEM

17 Radial and secondary network distribution systems for use in industrial plants and power stations are described in book B-2306. Westinghouse Electric & Mfg. Co.

INSULATING MATERIALS

18 A 42 page guide book on electrical insulating materials. Mitchell-Rand Insulation Co.

UNIT HEATER

19 Catalog No. 141, consists of 36 pages of description, engineering data, tables and illustrations pointing out proper location of units in various types of building. Ilg Electric Ventilating Co.

LIGHTING

20 Folder GEA-364 is entitled "Lighting for Industrial Plant Protection". It covers property-line, area, and emergency lighting. General Electric Co.

INSTRUMENT

21 Descriptive data 85-910 covers a pocket-size vibrometer for use in detecting and measuring mechanical vibration in motors, generators and other rotating machinery. Westinghouse Electric & Mfg. Co.

FLUORESCENT LIGHTING

22 A folder of specification sheets on a number of fluorescent lighting fixtures for commercial and industrial use. The Edwin F. Guth Co.
[Continued on page 92]



THIS GADGET HELPS MAKE FLUORESCENT LIGHTING PERFECT—FOR YOU!

—by HYGRADE—

(A pioneer and leader in fluorescent)

IT'S CALLED A
"MIRASTAT"...
ITS INVENTION WAS
MOTHERED BY A QUALITY
NECESSITY

To give users of Hygrade Fluorescent equipment the proper, prompt kind of starting . . . long lamp life protection and performance . . . Hygrade engineers originated and patented a new and advanced type of starter to meet our high standards.

To list all the inventions . . . developments . . . betterments . . . contributed by HYGRADE to the progress of fluorescent lighting would fill this page.

But you can get the story—quicker and better—in any factory or store where HYGRADE installations are today producing *more light and better light* from each watt of current.

And there are hundreds of contractors right now cashing in on it—reaping the big rewards assured by the popularity of HYGRADE fluorescent lighting.

Here's a real, rich, proven opportunity for you!

We offer HYGRADE fluorescent lighting equipment . . . engineered and built completely by HYGRADE . . . covered by

one complete HYGRADE guarantee with 40 years' repute back of it.

And our well-known engineering mastery makes HYGRADE installations welcome everywhere.

To your advantage is the fact that . . . we're more interested in making the best—than in making the most. We see that as the surest way to maintain our place as a pioneering leader in this field.*

ASK YOUR JOBBER FOR THE FACTS—or write Dept. EC-1.

*NEARLY 100 PATENTS PROTECT HYGRADE LIGHTING PRODUCTS! Extraordinary lighting efficiencies are obtained in Hygrade Fluorescent Lamps by tuning the ultra-violet energy to the 2537 Angstrom Units wave length effective in causing the porous film (Hygrade Patent No. 2,096,693) to generate light as shown in Hygrade-controlled Patent No. 2,126,787. Hygrade products are exclusively protected by a large number of other patents, including No. 2,201,817 and No. 1,982,821.

HYGRADE SYLVANIA CORPORATION

Salem, Mass. Est. 1901.

Also makers of Hygrade Incandescent Lamps and Sylvania set-tested Radio Tubes.

HYGRADE—*Everything in Fluorescent at its Finest*



Brilliantly illuminated section of Sperry Gyroscope Company plant, Brooklyn, New York. Here skilled workers produce defense products for Uncle Sam.

New Literature

[FROM PAGE 90]

V-BELT

23 Bulletin B-6190 illustrating and describing Super-7 V-belts. Selection tables as well as price lists are included. Allis-Chalmers Mfg. Co.

TOOL GRINDERS

24 Bulletin GT-135, covers cemented carbide tool grinders. It gives specifications and also illustrations on adjusting and methods of using grinders. Carboly Company, Inc.

LIGHTING EQUIPMENT

25 A 12 page folder featuring industrial lighting fixtures. It is profusely illustrated with pictures of various applications. Fostoria Pressed Steel Corporation.

OUTLET BOXES

26 Catalog No. 117 illustrates and describes combination floor boxes and pedestals, switch and starter pedestals, weatherproof junction boxes, test receptacles and floor boxes. Walker Electrical Co.

VENTILATOR

27 Bulletin No. 600-A features the clipper blower for installation in kitchen ceilings over the range. Trade-Wind Motorfans, Inc.

TRANSFORMERS

28 Bulletin No. CV-74, consists of 24 pages of description, charts, graphs and photographs of constant voltage transformers. A hand book for those concerned with defense plant lighting, and production. Sola Electric Company.

Circle numbers, sign and paste on a penny postcard or mail in an envelope.

ELECTRICAL CONTRACTING

330 West 42d St.

New York, N. Y.

January

(Not good after March 1)

Please send me without obligation, manufacturers' literature herein described and identified by numbers circled below.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54	55	56	57	58	59	

NAME TITLE

COMPANY

ADDRESS

CITY STATE.....

BUS DUCT

29 Bulletin 412, consisting of 12 pages illustrates and describes LO-X (low reactance type) bus duct for large ampere capacities. Bull Dog Electric Products Co.

JACKS

30 Bulletin No. 1066 is a vest pocket catalog consisting of factual data of all types and sizes of jacks. The Buda Company.

PORCELAIN WIRING

31 A question and answer booklet on the application of porcelain wiring to the electrical system. Porcelain Products Incorporated.

LIGHTING

32 A booklet entitled "Christmas Greetings with Light" contains suggestions for lighting indoors and out, including many detailed plans. Westinghouse Electric & Manufacturing Co.

INDUSTRIAL CONTROL

33 Folder GES-2029 is entitled "Maintenance Guide on Industrial Control". It gives suggestions to get the best performance from industrial control equipment and tips for speedy trouble shooting. General Electric Co.

CONNECTORS

34 Bulletin 103 illustrates and describes a wide variety of types and sizes of power connectors. O. Z. Electrical Manufacturing Company.

TOOLS

35 Catalog No. 33E consists of 48 pages of data and illustrations on many kinds of tools for the electrician, carpenter and plumber. Greenlee Tool Co.

FLOAT SWITCHES

36 Bulletin J-1 contains specifications, illustrations, price lists, dimensions and installation diagrams on Type "J" float switches. Automatic Control Co.

RESISTORS

37 Bulletin 26 illustrates and describes fluorescent lamp resistors for 14 to 40 watt lamps operating on direct current. Ward Leonard Electric Co.

ELECTRICAL EQUIPMENT

38 Catalog No. 106 consists of 12 pages of data on fuse groups, entrance switches and panels. Walker Electrical Co.

FLUORESCENT LIGHTING

39 A folder with data sheets describing and illustrating fluorescent lighting fixtures for industrial, commercial and residential use. Lighting Products, Inc.

DOOR CHIMES

40 Catalog consisting of 16 pages of data on the Edwards line of electric door chimes. It features illustrations and a guide chart for selecting correct chime. Edwards & Co.

TRANSFORMERS

41 Bulletin B6171, 20 pages, gives core and coil construction of circular coil, shell type high voltage power transformers. Allis-Chalmers Mfg. Co.

INFRA-RED

42 A new manual, PS-29, on the near infra-red process, covering applications in the industrial, printing and motor-baking fields. Fostoria Pressed Steel Corporation.

LIGHTING

43 Lighting book 82-L, consisting of 212 pages, presents data on modern lighting equipment for commercial, industrial and flood-lighting requirements. It contains many illustrations. General Electric Supply Co.

PUMPS

44 Bulletin B-6059 consists of 8 pages and features this line of centrifugal pumps. Allis-Chalmers Mfg. Co.

WIRING DEVICES

45 A 16-page booklet entitled "Wiring Devices for National Defense." It is a summary of the P&S line to provide a ready reference for the selection of materials for construction, repair and maintenance under the Defense Program. Pass & Seymour, Inc.

TOOLS

46 Catalog No. 37 gives descriptions, specifications and prices on the Thor line of universal type electric

[Continued on Page 96]



Here's "WET LOCATION" WIRE with 48 to 79% LESS WEIGHT

HAZARD WATERTITE TYPE RW—for use instead of lead-sheathed wire in wet locations... eliminates lead wipes... makes installations simple... saves time, money and space.



FOR WET LOCATION WIRING you can't afford to overlook all these advantages that HAZARD Watertite, Type RW, provides.

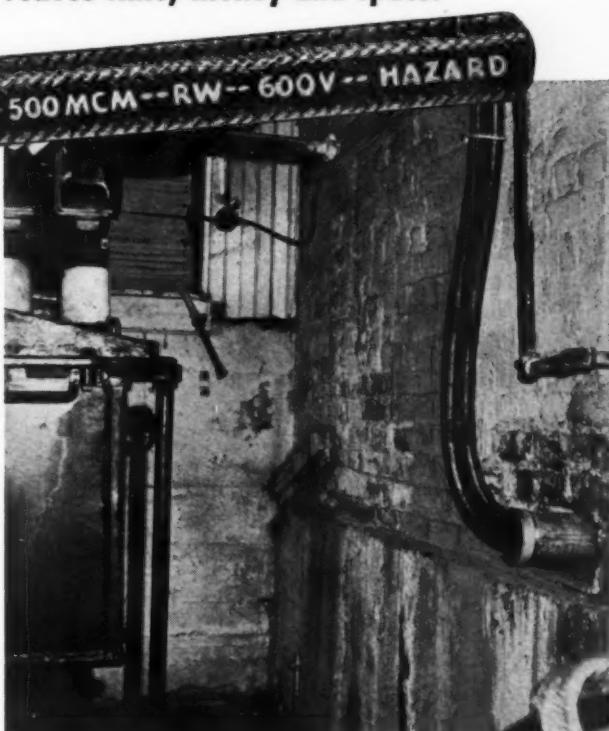
Because it doesn't need any lead sheath, up to 79% in weight is saved . . . which, of course, makes handling easier, installation faster, cost of job more economical. What's more, Hazard Watertite is spliced like any other rubber insulation. When used in a duct, the naturally smaller diameter of HAZARD Watertite saves valuable space or reduces the size of the duct required.

HAZARD Watertite is backed by laboratory tests of seven years under water with no great loss of the insulating qualities . . . plus hundreds of on-the-job performance records. In addition to this unusually high moisture-resistance, HAZARD Watertite Rubber Insulation is strong and tough . . . has a tensile strength of over a ton per sq. inch.

HAZARD WATERTITE, TYPE RW, fully meets the requirements of the National Electrical Code, Section 3035, for wiring in wet locations.

See the Difference in Weight and Diameter!

	HAZARD Watertite Type RW Size 4/0	Lead Covered Type RL Size 4/0
Approx. O. D. Inches	.78	.84
Approx. Net Weight Per M Ft.	814 lbs.	1570 lbs.



Typical use of Hazard Watertite, Type RW, in a wet location.
3 1/C 500,000 CM Hazard Watertite, 220 volts, used from transformer back through building wall and underground in pipe to next building in manufacturing plant.

HAZARD INSULATED WIRE WORKS

DIVISION OF THE OKONITE COMPANY

Works: Wilkes-Barre, Pennsylvania
Offices in Principal Cities



YOU'RE RIDING WITH when you sell Fluorescent Lighting



*Heres
why*



50 rigid tests by impartial Electrical Testing Laboratories, such as this on temperature rise, guard FLEUR-O-LIER value for you and your customers.



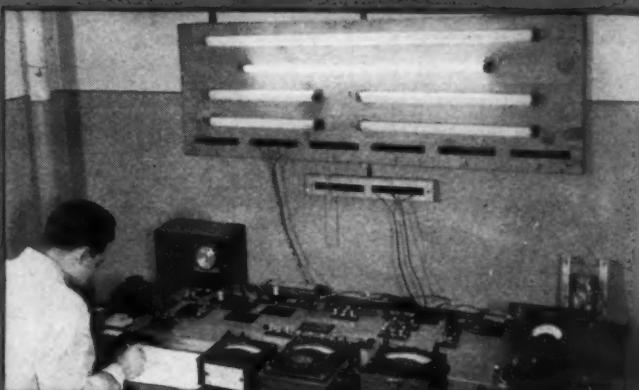
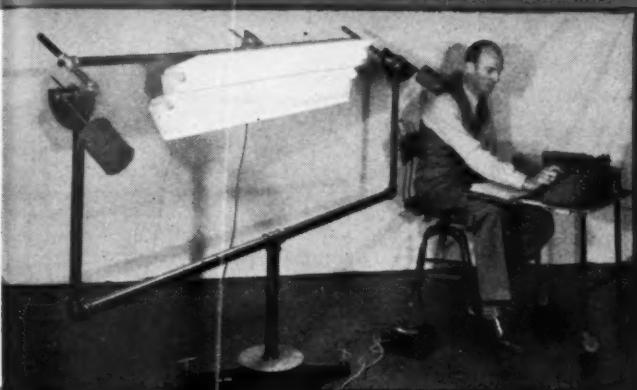
Certified starters. This test, under "failed lamp" conditions, one of the toughest tests a starter can have, checks starter operation . . . helps insure long life and high quality performance.

FLEUR-O-LIER

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer

A WINNER

Fixtures labelled FLEUR-O-LIER



FLEUR-O-LIERS give maximum light output, valuable help for vital "all-out" production. And their efficient lighting performance is verified by impartial experts through tests like this.

Certified ballasts. This test checks ballasts to insure reliable, balanced operation. It looks like a long pull ahead. So, today, certified high quality equipment is more important than ever!



This full page in January 24th SATURDAY EVENING POST heads powerful advertising drive in consumer and trade magazines... helps you Sell!

* tested
* certified
* guaranteed
* advertised

FLEUR-O-LIERS

Over 35 leading fixture manufacturers make FLEUR-O-LIERS, in 150 different sizes, types and designs... all certified by Electrical Testing Laboratories as meeting 50 specifications set up by MAZDA lamp manufacturers for the protection of you and your customers.



TEAR OUT AND MAIL

Fleur-O-Lier Manufacturers • 2122-1 Keith Building, Cleveland, Ohio
Please send me FREE new booklet "50 Standards for Satisfaction," together with list of Fleur-O-Lier manufacturers.

Name _____

Address _____

City _____ State _____

New Literature

[FROM PAGE 92]

VARNISHED TUBING

57 Reference folder No. 55-103 contains six samples of G-E varnished tubings and full information about them. General Electric Co.

NETWORK UNITS

58 Folder GEA-3686 features standard network units for secondary a.c. network systems. It gives outline dimensions and locations of accessories. General Electric Co.

MOTOR STARTER

59 Publication GEA-3660 explains in detail the design, construction and application of the new 2300-volt contactor motor starter which can be applied to high capacity power circuits. General Electric Co.

More Gossip

Plenty of Outlets

There are a total of 101 outlets in a new six room model home recently opened for inspection by D. J. Tierney, prominent realtor of Pittsfield, Mass. This adequately wired home, built by Edward J. Tierney, was inspected by more than 2000 visitors on opening day. John Adams was the electrical contractor who did the wiring job.

Code for West Bend

The West Bend, Wis. common council recently approved an electrical code for the city. It provides for the licensing of master and journeymen electricians and the establishment of a board of electrical examiners consisting of five members appointed by the mayor. Graduated fees are to be paid for electrical permits issued under the ordinance.



YEOMAN'S SERVICE in the promotion of state licensing of electrical contractors in New Jersey was provided by August Hasbrouck, Hackensack (left) and George Laikin of Hoboken, both active in the electrical construction industry.

MOTORS

54 Folder F-8623 gives eight pages of descriptions and illustrations on small motors from 1/6 to 1/2 hp., 145 frame size, for general use. Westinghouse Electric & Mfg. Co.

CONTROL DEVICES

55 Catalog No. 8301, consisting of 56 pages of data on industrial control devices for temperatures, pressures, flows, liquid levels and humidity. Brown Instrument Co.

ELECTRICAL FITTINGS

56 Catalog No. 1100 illustrates and describes plugs and receptacles and electrical wiring devices for locomotives and railway cars. The Pyle-National Company.

These Are The "MUST" Specifications For Units To Be Employed In Victory Production Lighting

STAND UP DAY AND NIGHT

... HEAVY DUTY WAR PRODUCTION SERVICE MUST NOT BE INTERRUPTED BY LIGHTING EQUIPMENT FAILURE DUE TO CHEAP OR FLIMSY CONSTRUCTION.

BE PROPERLY DESIGNED

... TO SHIELD THE EYES OF WORKERS AGAINST GLARE AND PROVIDE EFFICIENT, UNIFORM LIGHT DISTRIBUTION.

CONSERVE POWER

... BY PROVIDING WITH THE ABSOLUTE MINIMUM OF POWER CONSUMPTION THE HIGH LIGHT LEVELS OF 35 TO 100 FOOT-CANDLES REQUIRED FOR VICTORY PRODUCTION.

NOT WASTE LIGHT

... THE REFLECTING SURFACE MUST HAVE HIGHEST PRACTICAL REFLECTION FACTOR AND MUST BE EASILY MAINTAINED AT ORIGINAL EFFICIENCY.

They **MUST**

CONFORMANCE IS ASSURED WHEN YOU SPECIFY BENJAMIN FLUORESCENT LIGHTING EQUIPMENT

THE lighting must not fail! There can be no blackout of production due to lighting equipment failure. Neither can there be waste of power or light! Day and night production must be maintained at its highest possible rate with lighting that speeds seeing, conserves the eyesight of the workers, and helps them to sustain production speed and product quality, with a minimum of fatigue.

These are the specifications met by Benjamin Fluorescent Lighting Units. Designed and constructed with that extra safety factor of strength and durability which Benjamin through 40 years of experience has found essential in industrial lighting, these units can be depended upon to provide lighting that will not fail! Protected by Benjamin life-time porcelain enamel finish, these units are constructed to withstand the severe mechanical strains

to which they may be exposed in ordnance and industrial plants . . . smoke, fumes, grime, dust, weather, etc. With this finish, maintenance of original lighting efficiency is assured as this surface does not corrode, tarnish, oxidize or decompose and can easily be cleaned and restored to original efficiency with soap and water.

Available for the lighting of plants engaged in the production of war materials and essential civilian production are: Benjamin RLM "Lite-Line" equipment which provides continuous lines of light across the entire ceiling . . . Benjamin RLM "Stream-Flo" Units, and Benjamin Dust Tight Fluorescent Lighting Units, for requirements of armament plants and other Type II-G hazardous locations. For complete details, address Benjamin Electric Mfg. Co., Dept. H, Des Plaines, Illinois.



In the News

BEARD NAMED PUBLISHER

Announcement has been made by the McGraw-Hill Publishing Company, Inc. of the appointment of William K. Beard, Jr. as publisher of *Electrical Contracting* and *Electrical World*. He has been manager of *Electrical World* since 1935 and of *Electrical Contracting* since 1940.

Mr. Beard is a graduate of the Wharton



W. K. BEARD, JR.

School of Commerce and Finance of the University of Pennsylvania and has been associated with McGraw-Hill since 1924.

NEW P-100 REPAIR ORDER REVOKES P-22

A new Maintenance and Repair Preference Order P-100 was announced by O.P.M. on December 18. It takes the place of P-22, now revoked. The differences between P-100 and P-22 are largely technical. Some provisions of the old plan have been liberalized and a number of points cleared up.

Main purpose of the new order, as was the case with the old, is to extend priority assistance to manufacturers and producers so that they can keep their plants and production machinery in good running order. The assistance granted by the order is not

available for retail operations. It is available, however, to the following:

- (1) any governmental unit;
- (2) any enterprise engaged in one or more of the following capacities:
 - (a) manufacturing, processing or fabricating;
 - (b) warehousing — maintaining warehouses for storage or distribution of any material;
 - (c) wholesaling—acting as a distributor of products sold to manufacturers, wholesalers, retailers or other persons not consumers;
 - (d) charitable institutions—any charitable or eleemosynary institution which is recognized as such for purposes of the Internal Revenue Laws of the United States;
 - (e) carriers—urban, suburban, and interurban common or contract carriers of passengers or freight by electric railway, electric coach, motor truck or bus, including terminals of any of the foregoing; railroads, including terminals; shipping — commercial carriers of freight and passengers by ocean, lake, river or canal, including terminals;
 - (f) educational institutions;
 - (g) printers and publishers;
 - (h) radio — commercial broadcasting and communication;
 - (i) telephone and telegraph communication, including wire services;
 - (j) hospitals, clinics and sanatoriums;
 - (k) petroleum and natural gas—discovery, and development of pools of petroleum and derivatives thereof, and transportation of petroleum and derivatives thereof;
 - (l) irrigation systems, toll bridges and toll canals;
- (3) Any person using tools or equipment to repair or maintain the property of any producer as defined in the Order.

The former restriction on acceptance of materials for inventory of maintenance, repair or operating supplies by producers using the order has been changed to permit inventory not exceeding 110 per cent of the dollar volume of such materials purchased during the corresponding calendar quarter of 1940.

Special attention is called to provisions of the order which grant priority aid to: "Any person using tools or equipment to repair or maintain the property of any Producer as defined."

The above permits welding repair shops, blacksmith repair shops, small machine repair shops and other persons whose business is primarily a repair function to use this order to maintain their own establishments. It also permits such persons to procure the necessary tools and other items consumed in their repair business.

This also applies to the acquisition of mechanics' hand and fine mechanical measuring tools when purchased by a mechanic for use in his capacity as an employee of a plant engaged in defense work. He may sign the P-100 certification by simply stating where he is employed.

Any plant or business qualified to use the rating can do so without making application for its use. He places his repair order with a supplier and on the face of the order signs the following statement:

"Material for Maintenance, Repair, or Operating Supplies—Rating A-10 under Preference Rating Order P-100, with the terms of which I am familiar."

Questions about order P-100 should be addressed to the Maintenance and Repair Section, Office of Production Management, Washington, D. C.

MULTIPLE CONDUCTORS APPROVED

The Electrical Committee, National Fire Protection Association, has announced that Tentative Interim Proposal No. 39, relating to conductors in multiple, has been approved by letter ballot, and recommended for the National Electrical Code.

The proposal replaces the present text of Section 3008 with the following: "3008. Conductors in Multiple: Conductors in sizes 1/0 to 500,000 c.m., inclusive, may be run in multiple provided they are of the same length, have the same circular-mil area and type of insulation and as few conductors as possible for the type of insulation are used. Except as herein provided conductors shall be run in multiple only by special permission or as permitted in Section 6205. Where conductors are run in multiple they shall terminate at both ends in pressure connectors so ar-

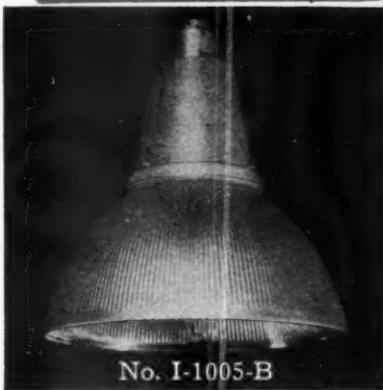


OLD FRIENDS MEET—Jack Bartlett (left), Electric Institute of Washington, D. C.; Nels Christopherson, Electric League of Milwaukee; and Walter Zervas, Electric League of Indianapolis, Inc., enjoy a good story at the annual League Conference at Washington.

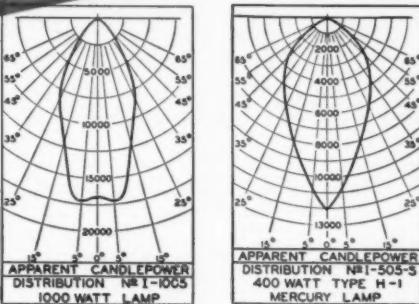
V for our battle of production

Engineered -- Controlled PERMAFLECTOR INDUSTRIAL LIGHTING

Permaflector—the silver mirrored glass reflector with the permanent efficiency



No. I-1005-B



Throughout Defense and now through War, Permaflectors do double duty by assuring industrial users the profitable benefits of utmost lighting efficiency and by saving critical metals for requirements of Victory.

MERCURY VAPOR and INCANDESCENT INDUSTRIAL LIGHTING

Permaflector No. I-1005-B is available immediately to any industrial plant in any quantity—is the perfect answer to efficient high bay plant lighting where unit is not subjected to severe vibration, shock or contact with moving objects—uses only a few ounces of metal—therefore requires no Priority Rating Certificate—can be installed quickly by attaching directly to conduit, stem hanger or nipple.

Permaflector No. I-505-S is equipped with a steel protective enclosure—concentrates light efficiently from mounting heights 25 feet or more—accommodates 500 or 300-watt incandescent lamps and the highly efficient 400-watt, Type H-1, mercury lamp.

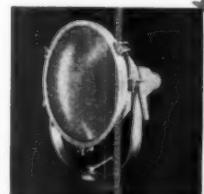
PERMAFLECTOR FLUORESCENT INDUSTRIAL LIGHTING

High bay fluorescent lighting was recently made practicable by the introduction of silver mirrored glass Permaflector No. T-11 for use with F lamps. Permaflector No. T-11 provides new higher intensities at normal mounting heights and greatly extends the effective range of lighting with F lamps. Permaflector Combination No. T-1148-RCE consists of four Permaflectors No. T-11 and



No. I-505-S

PROTECTIVE LIGHTING



Permaflector Floodlights are available for exterior service to combat sabotage or provide high levels of illumination in work areas—Floodlight No. AL-10 Series for broad distribution—Floodlight No. AL-11 Series for intense concentration—for use with 1000-watt or 750-watt incandescent lamps.

SAVES CRITICAL METALS FOR WAR NEEDS

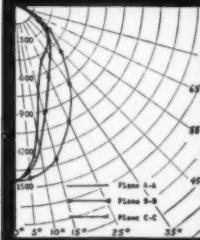
PROVIDES MORE LIGHT FOR PRODUCTIVE SEEING

READY-TO-INSTALL UNITS PROMPTLY DELIVERED

SLASHES TIME OF INSTALLATION, MAINTENANCE

No. T-1148-RCE

No. T-140-PE



Distribution Chart
Four No. T-11 Permaflectors, One 40-watt, 48-inch F lamp.

a skeleton metal holder for use therewith—attached to wired channel and quickly installed—accommodates one 40-watt, 48-inch F lamp—each unit saves several pounds of metal.

Permaflector Industrial Fluorescent Unit No. T-140-PE is equipped with a steel protective housing—uses one 40-watt, 48-inch F lamp—may be supplied with or without plastic enclosure—wired ready-to-install.

TIME-SAVING ENGINEERING SERVICE

Complete industrial lighting layouts and recommendations are available to industrial lighting users as a part of the Permaflector Engineering Service. Consult your nearest Permaflector Representative today or write direct to engineering headquarters in Pittsburgh.

PITTSBURGH REFLECTOR CO. EC-1-42
403 Oliver Building
Pittsburgh, Pa.

Please rush complete data on Permaflector Fluorescent and Incandescent Lighting.

Name.....

Firm.....

Address.....

[FROM PAGE 98]

ranged as to insure equal division of the total current between all conductors that are involved."

The interim revision is the result of action taken at the Electrical Committee meeting on June 11, approving a simplified practice standard eliminating No. 5, No. 3 and all over 500,000 c.m. wires from regular stocks. At that time a technical subcommittee was instructed to review the paragraphs of the Code affected and report on the changes necessary.

The proposal as prepared by the technical subcommittee was submitted to the membership of the Electrical Committee for vote on October 7.

METZ HEADS A.W. EXECUTIVE COMMITTEE

Herbert Metz, Graybar Electric Co., was elected chairman of the Executive Committee of the National Adequate Wiring Bureau at a recent meeting of that group in New York. He succeeds W. E. Sprackling, vice-president, Anaconda Wire & Cable Co., who has so ably guided the affairs of the Bureau since this all-industry program was launched nearly four years ago.

Mr. Metz, who is general lamp and



HERBERT METZ

lighting sales manager of the Graybar organization, has a wide background of experience in the electrical industry. He has already made outstanding contributions to the A.W. program as chairman of the Plan Committee since its inception.

PRIORITY FOR PARTIALLY BUILT HOMES

A broad plan to make materials available for completion of privately financed dwellings for which foundations were in place on October 9 will be put into effect shortly under Preference Rating Order P-71.

The program covers private dwelling units which cannot qualify for assistance under the Defense Housing Plan—Preference Rating Order P-55.

An A-10 preference rating will be made available for materials necessary to complete homes and apartment buildings now under construction. Assistance will be given only if foundations were completed as of October 9, the date the Supply Priorities and Allocations Board announced its general construction policy. It was estimated that approximately 70,000 private dwelling units now under construction are in the classification covered. On an overall average, these buildings can be considered half completed. Therefore, in making an estimate, the order is designated to make available the equivalent materials for 35,000 completed houses.

The A-10 preference rating may be applied only to materials on the Defense Housing critical list issued in connection with Preference Rating Order P-55.

RALPH B. WARD RETIRES

Ralph B. Ward retired as chief electrical inspector of the Department of Public Safety, City of Newark, N. J., December 31, after 27 years of service in that post. During his regime the department has expanded from five employees to 10 inspectors and four clerks.

Mr. Ward's activities in electrical safety were national in scope. For twenty years he represented the International Association of Electrical Inspectors on the Electrical Committee, NFPA. In this capacity he took active part in code revisions. He was also former president of the Eastern Section, IAEI; and the Essex Electrical League of Newark. He is also a member of the American Institute of Electrical Engineers, a major in the Quartermasters Corps, U. S. Army Reserve and was former vice-president of the Newark Chapter of the Reserve Officers Association.

Mr. Ward will be honored at a testimonial dinner at the Newark Athletic Club, January 14, given by the Essex Electrical League. Edward J. White, local contractor, is chairman of the dinner committee.

ESSEX LEAGUE ELECTS '42 SLATE

Emil C. Heidt, vice-president of Turtle & Hughes, electrical wholesalers, was elected president of the Essex Electrical League at the annual meeting held recently in Newark, N. J. Mr. Heidt succeeds Thomas M. Hunter, president of the American Transformer Co., who now continues on the executive committee.

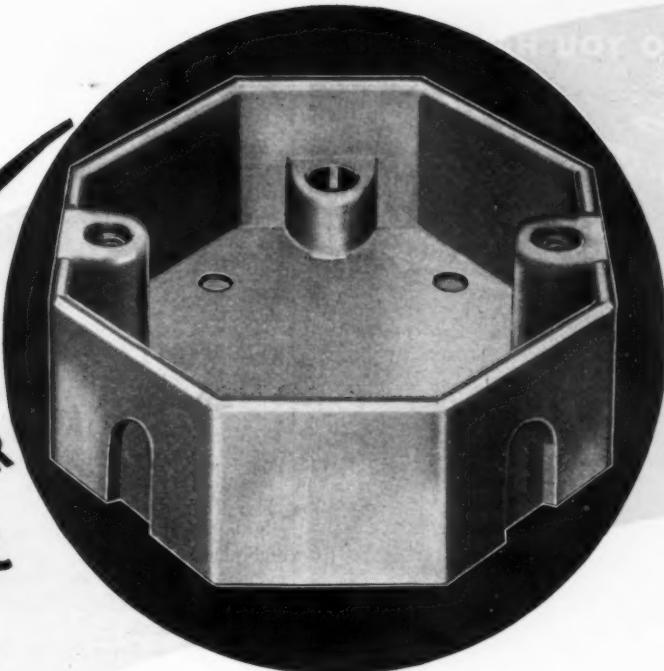
Joseph Buhl, Buhl & Caffrey, electrical contractors, was elected vice-president and Ralph Morrison, General Electric Lamp Division, was named treasurer. James Stapleton, Public Service Electric and Gas Co., was re-elected secretary. Two new



"With these electric eyes we don't have to wait now for her to cackle when she lays an egg."

Save

* 74,000 TONS OF STEEL
1,400 TONS OF RUBBER
600 TONS OF ZINC



This large tonnage of defense materials would be available for the War Effort if Porcelain Protected Non-Metallic Wiring Methods were used.

BULLETIN

Defense Production aided through Electrical Industry's use of All-Porcelain Boxes. Action releases vital metals for defense needs.

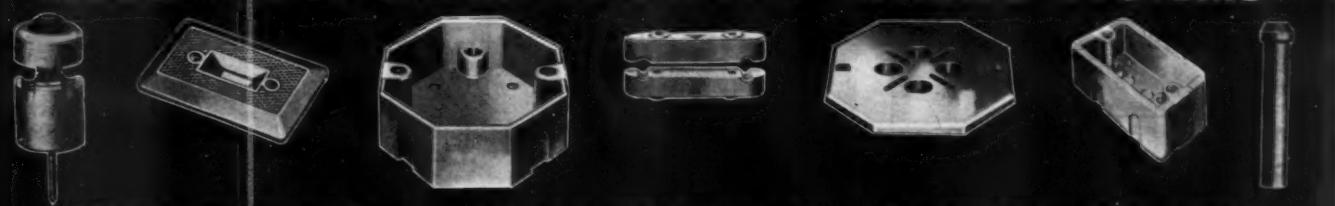
The responsibility of the Electrical Industry and its urgent need to cooperate in the War Effort is recognized by OPM, REA, FHA, QMC, and other Government agencies. To encourage a wider use of Porcelain Protected Wiring Systems, the Office of Production Management has listed these methods of wiring (Knob and Tube and Non-Metallic

Sheathed Cable) as the preferred methods for non-fireproof construction, while other Government agencies have made recommendations of their own to effect conservation of vital materials. Porcelain Protected Wiring Systems require the least amount of critical materials and conserve the greatest amount of steel, zinc, copper, and rubber.

* Estimated figures from Edison Electric Institute

Materials for Modern Porcelain Protected Wiring Systems—Porcelain Knobs, Tubes, Cleats, Outlet Boxes, Switch Boxes, and Covers may be obtained through your wholesaler and are manufactured by

MODERN PORCELAIN PROTECTED WIRING SYSTEMS

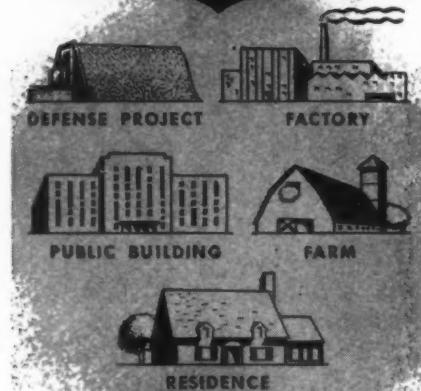


* ILLINOIS ELECTRIC PORCELAIN CO.
Macomb, Ill.

* KNOX PORCELAIN CORPORATION
Knoxville, Tennessee

* PORCELAIN PRODUCTS, INCORPORATED
Findlay, Ohio

DO YOU HAVE
*Something to do
 with These
 Buildings?*



**THEN WEST DODD CAN GIVE YOU
 RELIABLE PROTECTION AGAINST
 A LEADING CAUSE OF FIRE!**

Without lightning protection there is no complete defense against loss from fire. For records of the National Board of Fire Underwriters' prove that lightning ranks at the very top as a source.

In times like these, when all America is striving to conserve resources...when repairs or replacement may be difficult and expensive...full defense against the hazards of fire takes on new values.

Lightning protection is so easily obtained and the National Fire Protection Association states, "There are few fire causes against which so reliable a defense is available."

West Dodd materials and methods of installation are approved by the National Board of Fire Underwriters', the American Institute of Electrical Engineers, and other competent authorities. Widely used on National Defense Projects for lightning protection and static control. INCONSPICUOUS West Dodd applications are available for every type of building at moderate cost.

Investigate today. Write West Dodd, the oldest name in lightning protection.

WEST DODD LIGHTNING CONDUCTOR CORP.

A RELIABLE PROTECTION AGAINST
 A LEADING CAUSE OF FIRE



420 LEXINGTON AVE., NEW YORK CITY
 GOSHEN, INDIANA

FREE estimating and engineering service to electrical contractors on installations when inquiry is accompanied by blueprints of all elevations and roof detail showing location of soil pipes, metal ventilators, etc. Write for literature.

In the News

[FROM PAGE 100]

members were added to the executive committee. They are Wallace K. Brown, vice-president, Crocker-Wheeler Electric Mfg. Co., and Edward J. White, E. J. White Co., electrical contractors.

REA ALLOTS

5 1/2 MILLION

Allotments of \$5,521,500 for rural power facilities in 11 states was announced on December 10 by R.E.A. Administrator Harry Slattery. None of the allotments contemplate purchase of new supplies or equipment. The funds will be used to pay excess costs of work already contracted, to acquire properties or to utilize materials already at hand.

REA allotments, the report stated, now total \$431,253,321 since its establishment in 1935.

CONTRACTOR OPEN FORUMS

The Independent Electrical Contractors Association, Inc., New York City, decided at its recent meeting to continue holding joint open forum meetings with other electrical contractor groups in the city to discuss current business problems.

The initial meeting of this type drew an attendance of more than 300 contractors from eight local organizations. At that time the subject of priorities was discussed with a local OPM official. The next meet-

ing will be devoted to a review of contract distribution—how defense business is subcontracted and what chances the electrical contractor has of getting some of this work. Future meetings will cover subjects of vital interest to the electrical contractor at that time.

Officers reelected for the coming year are: president, J. S. O'Brien; 1st vice-president, N. D. Lyons; 2nd vice-president, Joseph Donnath; treasurer, John J. Bauer; financial secretary, Wm. Drexler; recording secretary, Albert A. A. Tuna and sergeant-at-arms, Cornelius Fitzgerald.

CANADA CARRIES ON

In spite of Canada's armament program and the resultant shortage of materials for electrical construction, the Electric Service League of British Columbia is continuing its activities in the educational field.

Commercial and industrial lighting presentations are being planned for industry groups, service clubs and other organizations. Its home lighting advisory department is continuing to serve the industry and reports considerable interest in home lighting in general.

Educational activities, although postponed in the appliance merchandising field, are being concentrated on the enlightenment of contractors in electrical wiring and lighting. At the same time the power company is developing an educational program on fluorescent lighting.

U.S.O. CENTER BID INFORMATION

The construction of U.S.O. recreation centers in Army posts, camps and stations is to be done under the supervision of the



NORTHWESTERNERS from the great open spaces where men are men and . . . Well, anyway, the boys enjoying cocktails at the recent I.A.E.L. conference in Washington are (L. to R.) Al Kessler, Minneapolis; Gene Zachman, Cincinnati; Herb Wilson, Rock Island; Walter Zervas, Indianapolis; Bill Ritt, Minneapolis; Jerry Weston, Kansas City and Carl Christine, St. Louis.

construction division, Office of the Quartermaster General, War Department.

Inquiries from contractors should be directed to the office of the Zone Constructing Quartermaster nearest the contractor's main office.

Zone 1.—Headquarters, Lt. Col. Shirley W. McIlwain, Army Base, Boston, Mass.; serves Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont.

Zone 2.—Headquarters, Col. M. A. McFadden, 120 Wall Street, New York, N. Y.; serves Delaware, New Jersey, New York.

Zone 3.—Headquarters, Lt. Col. J. H. Burghheim, Standard Oil Building, Baltimore, Md.; serves Maryland, Pennsylvania, Virginia.

Zone 4.—Headquarters Lt. Col. Frederick S. Strong, Jr., 494 Spring Street, NW, Atlanta, Ga.; serves Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee.

Zone 5.—Headquarters, Lt. Col. B. F. Vandervoort, 232 North High Street, Columbus, Ohio; serves Indiana, Ohio, Kentucky, West Virginia.

Zone 6.—Headquarters, Lt. Col. Everett C. Hayden, 20 North Wacker Drive, Chicago, Illinois; serves Illinois, Michigan, Wisconsin.

Zone 7.—Headquarters, Lt. Col. Ralph G. Richards, 14th and Farnam Streets, Omaha, Neb.; serves Arkansas, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, Wyoming.

Zone 8.—Headquarters, Col. E. V. Dunstan, Fort Sam Houston, Tex.; serves Arizona, Colorado, New Mexico, Oklahoma, Texas.

Zone 9.—Headquarters Col. E. M. George, 74 New Montgomery Street, San Francisco, Calif.; serves California, Idaho, Montana, Nevada, Oregon, Utah, Washington.

OHIO PROVIDES FOR COUNTY INSPECTION

To provide for building regulation in unincorporated portions of counties in Ohio, the state legislature has recently passed a bill empowering county governments to adopt and administer county building codes.

The administration of the building codes will be handled by a county building inspector who may contract with any municipi-



J. S. NIELSEN, president of J. S. Nielsen Electric Company, New Haven, Conn., has 32 years of experience in the electrical contracting business. Now, more than 85 per cent of the company's work is for defense plants.

No Shortage Here!

As a Patriotic Measure You can USE

PORCELAIN

To Conserve Steel, Zinc, Copper, Rubber

No. 8318½—Deep

No. 8318—3"

No. 8314—4"

Porcelain Outlet Boxes involve no critical materials—and the Nation needs, for our war effort, all the steel, zinc, copper, and rubber you can save with non-metallic wiring systems. For actual savings, see Porcelain ad on Page 101 of this issue.

Porcelain Outlet Boxes installed with Knob & Tube and Non-Metallic Sheathed Cable Wiring (as listed by OPM) provide for the greatest savings of critical metals.

At low cost, these boxes give superior safety plus long life. Clamps or connectors are out. Porcelain Boxes are corrosion-proof, rust-proof, fire-proof, short-proof, and shock-proof. Standard sizes, spacing, knockouts, etc., provide for the use of standard wiring devices and covers.

Do your part to conserve critical materials for our war effort—Use PORCELAIN Outlet Boxes (for non-metallic systems only). Write for literature today.

PORCELAIN PRODUCTS, Inc.
FINDLAY, OHIO

MEET YOUR CONTRACT DATES

Avoid Complaints, with IDEAL



QUICKER, EASIER, BETTER WIRE JOINTS



Ideal for Fluorescent Wiring

- Solderless, Tapeless Wire Connectors.
- Just strip wires, screw on—that's all!
- No solder, no heat, no open flame hazard.
- Better electrically—stronger mechanically.
- Makes craftsmanlike jobs—no messy joints.
- Sizes for all common wire joints.
- Fully approved: Listed by Underwriters' Laboratories, Inc.
- SAFER. PASS INSPECTION QUICKLY.

IDEAL

FISH TAPE, REEL and PULLER

- Prevents tape breakage.
- Keeps fish tape under control.
- Never "goes"! Size with 50 ft. $\frac{1}{8}$ " x .045" tape—only \$1.50.
- Many size Reels and Tapes available.



IDEAL

JOIST BORER

- Bores at any angle through joists, rafters, etc.
- No climbing—no stooping—no straining.
- Works up to 11 ft. above or below floor level.

IDEAL WIRE AND CABLE REEL

- Saves wire—eliminates snarls.
- Handles Nos. 18 to 2 wire, BX, Romex, etc.
- Keeps wire neatly coiled.
- Pays out smoothly and evenly.
- Hangs anywhere—singly or tandem.



IDEAL BX ARMOR CUTTER

- Pocket size. Inexpensive.
- Cuts armor from 2 or 3 wire No. 12 or No. 14 BX in one operation.
- No more nicked insulation, shorts or wasted BX.

Other IDEAL Time-Savers



Ideal Commutator Dresser Co.
1041 Park Avenue Sycamore, Illinois
"Sales Offices in All Principal Cities"

In the News

[FROM PAGE 103]

pality in the county for the use of its inspection services. The regulations adopted by each county will include provisions for electrical inspection.

Farm occupancies are specifically omitted from the law. In intent and in effect the regulations will extend city building codes to the rapidly growing suburban areas.

PIPE FITTINGS

STANDARDIZED

A new simplified practice recommendation covering grey cast iron, malleable iron and brass or bronze pipe fittings has been approved by the National Bureau of Standards, to be effective on new production after Jan. 1, 1942. The standard cuts from 8566 different items regularly offered to about 3000 items which, it is estimated, will satisfy 92 to 94 per cent of all customers.

PHILADELPHIA

GROUP ELECTS

The Board of Governors of the Electrical Association of Philadelphia re-elected A. L. Hallstrom president for 1942. This will be the fourth term for Mr. Hallstrom who is vice-president of Graybar Electric Company, Inc.

Other officers elected were: vice-president, Howard L. Miller, president of Utilities Engineering Co.; treasurer, Philip H. Ward, Jr., president of Ward Electric Co.; secretary, Robert J. Moran, chief of Electrical Dept., Middle Department Rating Association.



COMPLETE SERVICE, both wiring and motor repairs, for industrial plants is offered by the Bar-Craft Electric Co., New Haven, Conn. L. A. Barbashino (above) handles the construction end. Bob is so rushed these days that temporary machine connections are no novelty. When plant schedules allow, he books them up permanently.

MINERALLAC HANGER



Conduit $\frac{3}{8}$ "— $2\frac{1}{2}$ "
Cable to $2\frac{1}{8}$ " (with Bushings)

Cadmium and Everdur MINERALLAC JIFFY CLIP



Sizes from .250" O.D. Tubing
to $1\frac{1}{4}$ " conduit.

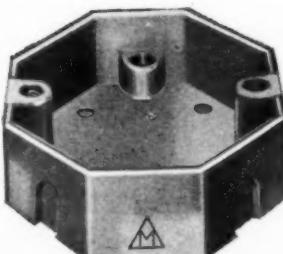
See your Jobber

New York City Office
Theodore B. Dally
50 Church Street

MINERALLAC ELECTRIC CO.
25 N. Peoria St., CHICAGO

ILLINOIS PORCELAIN OUTLET BOXES

For residential and farm wiring where permanency and utmost safety are required—for industrial installations where dampness or corrosive fumes are prevalent.



Knockouts for single wires of knob and tube and for two-wire and three-wire non-metallic sheathed cable.

ILLINOIS ELECTRIC PORCELAIN CO.
MACOMB, ILL.



SECRETARY - MANAGER H. W. Kellams of the Institute of Electrical Contractors of Washington, D. C., guides the activities of the local organization. Harry's boys are pretty busy with government work these days, both in and outside of the District.

MINNEAPOLIS PERMITS '37 WIRE TABLES

To aid in conserving rubber and copper, O. M. Frykman, chief electrical inspector of Minneapolis, Minn., has announced that his department will permit the installation of electrical conductors on the basis of the carrying capacities allowed in the 1937 Code.

NIAGARA GROUP NAMES DIRECTORS

Twenty-two directors were elected for one-year terms at the annual meeting and all-industry banquet of the Electric Association of the Niagara Frontier in Buffalo, December 15th.

They are: Charles Hahn, Jr., C. J. Rohrer, Weldon D. Smith, Richard Wahle and A. J. Wolfe, representing wiring contractors and dealers; George Campbell, R. H. Davison, R. D. Glennie, Karr Parker, K. L. Thielscher and Henry Vidal, representing jobbers and manufacturers; H. S. Andrews, E. T. Ball, H. J. Morganstern, K. R. Reid, E. F. Strong and L. A. Woolley, members-at-large and T. W. Connette, W. S. Schmidt, M. E. Skinner and C. P. Yoder, representing central stations, transmission and power companies.

K. C. CONTRACTORS GET BUSINESS MANAGER

The appointment of W. C. Bryant as business manager of the Greater Kansas City Chapter of NECA, has been announced by Fred Geiss, president of the group.

Mr. Bryant will pursue his new duties from his recently opened office at 654 Dwight Building, Kansas City.

WHEELER "DAY-LUX" FLUORESCENT LUMINAIRES FOR LIGHTING

Offices, Stores, Hotels, Clubs, Restaurants, Theatres, Public Buildings, etc.

Here is a new line of distinctive, beautifully designed Fluorescent luminaires made especially for general illumination purposes in commercial locations.

These fixtures furnish an abundant quantity of the soft, cool daylight illumination which makes seeing easy and working conditions ideal.

"DAY-LUX" Luminaires, which utilize 40-watt lamps, are available in two- or four-lamp construction.

All fixtures are supplied complete with white lamp holders, high power factor Tulamp ballast equipment, and removable and renewable separate starter switches located on the top of the units.

Reflectors are constructed of white enameled steel. Decorative end caps and canopy finished a beautiful crackled aluminum.

As illustrated, fixtures can be supplied with panels of frosted glass, or without glass.

All units are furnished with ballasts for 110-125 volts, 60 cycle A.C. operation.

Length of stems: 24" standard.

FOR MOUNTING CLOSE TO THE SURFACE

If desired for surface mounting, fixtures will be furnished with 6" stems.

*For complete data write for New Bulletin No. 65-A
Distributed Exclusively Through Electrical Wholesalers*

1881—60th Anniversary—1941



TWO LIGHT UNIT
WITHOUT GLASS PANELS

Wheeler

**REFLECTOR
COMPANY**

275 CONGRESS ST., BOSTON, MASS.
NEW YORK · CLEVELAND · REPRESENTATIVES IN PRINCIPAL CITIES

The MOST COMPLETE
LINE OF
Jee
Connectors

ALL good types
—any size.

With a hinged
clamp for the main,
the Penn-Union
Type HFM (at
right, and below)
is easy to apply.



Split sleeve contact
unit gives permanent grip
on branch.

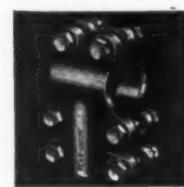
Made for single or multiple
branch connections.

ALSO CABLE TAPS—a
complete line of 90° and
Parallel taps, for one or
more branches.

COMPACT and POSITIVE. The Penn-Union Type SM gives equal tightening on the run and tap. Self-locking, dependable.



CLAMP TYPE TEES
for all sizes of tubing
and cable—a full line.
Machined contact surfaces.



MANY MORE TYPES—for all combinations. For connecting flat bar, run or tap, to tubing or cable. Also "general utility" tees that take a wide range of conductor sizes. You will find that the Penn-Union line has exactly what you need.



FOR ANY CONDUCTOR FITTING—Terminals, Service Connectors, Studs, Two-Ways, Ground Clamps—see the THOUSANDS in the Penn-Union Catalog.

Preferred by the largest users, who have found that *Penn-Union* on a fitting is the best guarantee of Dependability.

Sold by Leading Jobbers
Write for Catalog

PENN-UNION
ELECTRIC CORPORATION
ERIE, PA.

PENN-UNION
Conductor Fittings

In the News

[FROM PAGE 105]

COMING MEETINGS

American Institute of Electrical Engineers—Winter Convention, New York, N. Y. Jan. 26-30.

National Electrical Manufacturers Association—Midwinter meeting, Palmer House, Chicago, Ill. Feb. 16-20.

Minnesota Electrical Council—Annual Convention, Minneapolis, Minn. Feb. 22-24.

NEW DEFENSE AREAS CERTIFIED

Seven new towns have been added to those certified as defense areas, and included in the Defense Housing Critical Areas List.

Seven new communities, in which the construction of housing for defense workers may receive priority assistance, were certified as defense areas on Nov. 29. They are: Sebring, Fla.; Moultrie, Ga.; Ballinger, Coleman and Stamford, Texas; Duluth, Minn. and Superior, Wis.

A.W. LICENSING CONTINUES

In spite of the somewhat altered picture that OPM limitations have put on home building, additional local groups are making applications to certify adequate wiring.

The 53rd and 54th licenses were recently issued to the A.W. Bureaus at Janesville, Wisconsin and Mansfield, Ohio. The Janesville group, known as the Southern Wisconsin Adequate Wiring Bureau, covers Janesville and portions of Dane, Jefferson, Rock and Walworth Counties. The Mansfield group will cover the city and portions of Richland County, Ohio.



DEFENSE HOUSING is now occupying the time of Ray Werme, president of the Norwalk Electrical Co., Norwalk, Conn. Ray is completing a project of 100 two-family units in Fairfield, Conn.

KEEP 'EM WARM



...with this extra, portable heat

In the playroom, in the bathroom, in the living room—wherever it's needed—Thermador Portable Electric Heaters provide clean, healthful, extra warmth. Attractively designed, extremely light, amazingly economical—these efficient little heaters are the modern answer to chilly mornings and evenings. You'll like their looks, their economy, their comforting warmth.

Available in three
models as illus-
trated below.

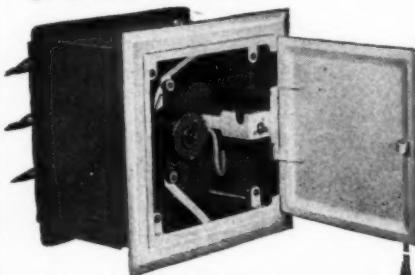


Heat Fan

THERMADOR
5119 SO. RIVERSIDE DRIVE, LOS ANGELES, CALIF.
230 MADISON STREET, OAKLAND, CALIFORNIA



Every HOME NEEDS
THIS SIGNAL
Vent FAN.....



Wall Box built-in type for permanent installation—in new or old homes—to fit walls 6" to 24". Automatic lever-operated shutters—10" quiet type fan-enclosed motor—inside door for weather protection—opening and closing door operates motor and shutters are among its important features—plus others you should learn about. Write for complete details.

SIGNAL ELECTRIC MFG. CO.
Menominee, Michigan
Offices in all principal cities.

SIGNAL

WITH THE
Manufacturers

Graybar Elects New Officers

The board of directors of Graybar Electric Company elected A. H. Nicoll as the new president and three new vice-presidents, G. F. Hessler, D. H. O'Brien and E. W. Cashman.

F. A. Ketcham, former president, becomes chairman of the board, and the following field vice-presidents continue in that capacity: W. P. Hoagland, Chicago; W. J. Drury, New York; and A. L. Hallstrom, Philadelphia.



Westinghouse Promotions

At a recent board meeting, T. I. Phillips was elected a vice-president of the Westinghouse Electric and Manufacturing Company. He started with the company in 1915 and for the past year has been assistant to the president of the company.

John H. Ashbaugh has been appointed manager of manufacturing and engineering of the Westinghouse merchandising division.



BullDog Electric Products Co., Detroit, announces the appointment of Herbert H. Benfield as New York District Manager. He assumed his new duties on December 1. Mr. Benfield was formerly sales manager of the Steel and Tubes Division of the Republic Steel Company.



John A. Roebling's Sons Company announced the appointment of Eugene King as manager of its Cleveland Branch. He was formerly assistant manager. Mr. King succeeds Raymond R. Newell, who retired on December 1. Mr. Newell had been associated with the Roebling Company for 39 years and had been in charge of the Cleveland organization since 1911.



FOR REPLACEMENTS

SELL G-E

FLUORESCENT STARTERS

Lamps	Starters	Contacts
6 in., 4 watts 9 in., 6 watts 12 in., 8 watts	FS-5	2
18 in. T-8, 15 watts 24 in. T-12, 20 watts	FS-2	2
36 in. T-8, 30 watts 48 in. T-12, 40 watts	FS-4	2
48 in. T-12, 40 watts	FS-4NA	2
48 in. T-12, 40 watts	FS-44**	4
36 in. T-17, 65 watts	FS-74	4
60 in. T-17, 100 watts	FS-64	4
60 in. T-17, 100 watts	FS-6*	2

*For replacement in 2-contact starter sockets.

**For low temperature starting. Must have separate starter socket 95X180.

Customers for whom you've installed fluorescent fixtures will need starters for replacement. Others using fluorescent lighting need starters replaced. Get this business with G-E starters. They are designed by MAZDA lamp engineers and have correct operating characteristics to provide normal fluorescent lamp life and performance.

The G-E starter line includes starters for fluorescent lamps of 4 to 100 watts, 6 inches to 60 inches in length. Some of these starters are 2-contact; others are 4-contact.

For further information see the nearest G-E Merchandise Distributor or write to Section D-281, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

GENERAL ELECTRIC

hook up with Sherman Connectors



WEDGE GRIP CONNECTORS

Special insert plate for greater thread strength. V-shaped corrugation grip wires securely. Headless, non-removable bronze screw, easy to tape.



SPLIT BOLT CONNECTORS

Precision machined from



Fixture Connectors

Two types—High copper bronze (illustrated) for inside or outside use; and Bakelite style with special Vee slot that holds wires firmly.



"BOND-ROD" GROUND CLAMPS

For driven ground rods. Heavy extruded bronze. Bronze screw with cup point. Strong, one-piece construction.



SOLDERLESS LUGS

Type SM, low cost one-piece design. May be soldered if desired.

Sherman solderless wire connectors and clamps are practical, efficient, easy to install, and surprisingly moderate in cost.

Write today for catalog showing Sherman electrical specialties. It will be sent promptly, without charge.

H. B. SHERMAN MFG. CO.
Battle Creek, Mich.

Sherman

ELECTRICAL CONNECTORS

In the News

[FROM PAGE 107]

Steel and Tubes Division of Republic Steel Corporation, announces the appointment of H. R. Coward as manager of Conduit Sales, with headquarters in the Cleveland office. He was formerly assistant midwest sales manager in charge of the company's conduit sales. He succeeds H. H. Benfield who resigned.



Chicago Pneumatic Tool Company, New York has promoted Joseph A. Sullivan to advertising manager. Mr. Sullivan was formerly assistant publicity manager.

E. R. Goss has been promoted to branch manager of its El Paso, Texas, office. Mr. Goss succeeds the late E. J. Coughlin.

General Electric Company has named J. W. McNairy as assistant manager of the G. E. Bridgeport Works. He was formerly assistant design engineer for the control division of the transportation division.

The Triangle Conduit and Cable Company, Inc. has moved its entire organization and executive offices to new headquarters at Triangle and Jersey Avenues in New Brunswick, N. J.

Edwin F. Guth Co. of St. Louis has named Dan Dunne as its representative in Iowa, Nebraska and Northern Illinois, including Chicago. Mr. Dunne was formerly with the Chase Brass & Copper Co.

Spang Chalfant, Inc. has named Frank W. Morris as manager of sales, West Coast territory, to succeed J. V. Greer, who has resigned. Mr. Morris' headquarters will be in the Ohio Oil Building, Los Angeles.

The Burlington Instrument Corporation of Burlington, Iowa, announces the appointment of Equipment Sales Division, 21 East Van Buren St., Chicago, as representatives in the Chicago territory.

Keystone Carbon Co., St. Marys, Pa., has opened an Eastern sales office at 249 High St., Newark, N. J. Robert McKeown and Charles V. Allen are district representatives, succeeding the late E. A. Berger, sales engineer.

A. A. Barbera & Co., 417 South Hill St., Los Angeles will be the representative in the Southern California territory.

Bunting Brass & Bronze Company announces the removal of its Atlanta sales office and warehouse to new quarters at 542 Spring Street, N. W. Also the Kansas City office to 1821 McGee Street.

Littlefuse, Incorporated, Chicago, opened a new plant at El Monte, California on November 1. It occupies 21,000 square feet of floor space.

More Gossip —

Hi-Cycle Heat

Moisture drying in round metal shapes following a degreasing bath takes in the order of several minutes by conventional methods. Frank Vogel, Edwards Electric Co. of Chicago, has applied several experimental methods to speed the process on a production line. The drying time was effectively reduced by means of an infra red heat tunnel, further reduced by induction heating with 60 cycle equipment. High frequency induction equipment is now being prepared to reduce the drying time to approximately six seconds.



EFFECTS OF LICENSING of electrical contractors by the State is discussed by (L to R) Arnold Kleiner, Newark; L. H. Lessner, Elizabeth and Edward Gardner, West New York, N. J., during a recess at the convention of the New Jersey Council of Electrical Leagues at Atlantic City.



ENTERPRISING CONTRACTOR
Edward Bauernschmidt of Baltimore, Md., makes a thorough coverage of the electrical construction field. He just completed some nice commercial jobs, a 400 unit single family housing project and is now busy at Uncle Sam's Aberdeen Proving Grounds.

Getting Tighter

A New Jersey electrical contractor doing work in a shipyard recently had to purchase some steel rail sections on which to mount several large transformers.

When asked how the material deliveries situation was, he replied, "I tried all over to get the rails and finally had to go to a junk dealer. Believe it or not, the junkie made me show my priorities rating before he would sell me the rails. That's how tough it is. But it has to be."

Address Change

Change of address of the Electrical Equipment Co., of Raleigh, N. C., and Richmond, Va., has been announced by J. M. Cutliff. The company's shops are now located at 9 West Main St., Richmond and 2526 Hillsboro St., Raleigh.

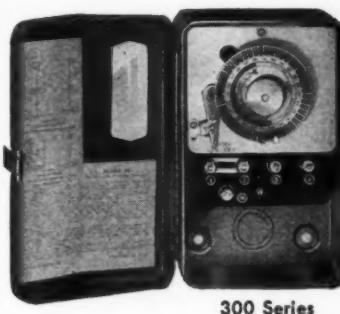
Boston Contractors Elect Officers

At the annual meeting and banquet of the Master Electricians' Association of Boston, the following officers were elected to guide the activities of the group during the coming year: Nat Rabin, president; Charles Devoe, vice-president; David Rambler, treasurer; George W. McShane, secretary.

Purchases Business

The New England Machine and Electric Co., Pawtucket, R. I., one of Rhode Island's larger electrical contractors, recently purchased the Whitehall Electric Co., of Westerly, R. I. Mrs. Ralph Segar was the former owner of the Whitehall concern.

How TO GET DEFENSE JOBS



ELECTRICAL Contractors are handling many types of defense jobs; but here's one offering big possibilities . . . install Paragon 300 series time switches for automatically turning flood lights off and on. Flood lights are being widely used for ship yards, munitions plants, parking lots, out door stock, company railroads, etc. For this purpose Paragon 300 series is ideal. It is easy to install, rugged and requires a minimum of service.

SAVE MAN-POWER

Another type of defense job open to electrical contractors is to install Paragon 900 series automatic timers wherever the timing of machine operations in manufacturing plants is involved. For example, plastic molding, rubber curing, batch mixing, liquid agitation, etc. These units save human effort and increase output per man to an almost unbelievable degree.

Write for THIS BOOK



A complete catalog describing industrial timers, time switches and other time control devices. Contains illustrations, construction and installation data, list prices and valuable reference information. Sent without cost or obligation. PARAGON ELECTRIC CO., 401 So. Dearborn St., Chicago, Ill.

Paragon Chicago

BUILDERS OF CONTROL INSTRUMENTS

SINCE 1905

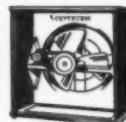
Sturtevant

REG. U. S. PAT. OFF.

Puts Air to Work



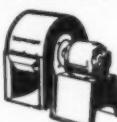
Sturtevant Design 7
Propeller Fan
Made in sizes 12" to 45"
inclusive
Capacities
— 680 to 15,450 c.f.m.
Direct connected motors
A.V. Propeller Fans also
available with belt drive



Atticvane Fan



Pressure Blower



Ventilating Set



Wind-O-Vane Fan



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STOCKS CARRIED AT MANY POINTS

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NOLAND COMPANY, INC.

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ILSCO SOLDERLESS CONNECTORS

HAVE YOU TRIED The New Ilasco Lugs?



BUILT FOR OVERLOADS!

The new design—as passed
by the Underwriters' Labo-
ratories May 1, 1940.

GENTLEMEN
Send me New Catalog and Sample

MAIL
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Firm _____

Address _____

City & State _____

**ILSCO COPPER TUBE
AND PRODUCTS, INC.**
5629 MADISON ROAD — CINCINNATI, OHIO

Load Center Distribution

[FROM PAGE 27]

A secondary voltage of 575 or 600 volts will generally extend the range of most economical sizes to include 1200 or 1500 kva. unit substations.

The average range of load density from 2 to 20 volt-amperes per square foot of floor space has no effect on the optimum size of unit substations.

In designing load center distribution systems, of importance are the basic considerations regarding power supply arrangement, primary voltage for distribution to load centers, and selection of secondary voltage. These are discussed briefly below.

Basic Supply System

In these times when sabotage may be of particular importance, it may be well to arrange the power supply to important defense plants so that there are two well-separated supply lines as shown in Diagram 1.

Having arranged the basic supply points, the next problem is that of selecting primary voltage for distribution through the plant. In general, if the supply voltage is 15 kv. or less it may be used without transformation. However, voltages above 15 kv. are generally considered too high from the standpoints of safety and the maintenance of cable. Hence a voltage transformation is necessary.

Standard voltages are 4160 volts and 13,200 volts. A voltage lower than 4160, such as 2400 volts, is desirable from the economic standpoint only if about one-half or more of the total load is most suitable to 2400 volt utilization, such as large motors. Voltages between 4160 and 13,200 are generally desirable only if a large portion of the load consists of very large motors which are best adapted to say 7200 volts instead of 4160 or 13,200. The principal reason for 4160 instead of lower voltage is that it utilizes 5-kv. switchgear more effectively and requires less copper to transmit a given amount of power than does 2400 volts. Similarly, 13,200 volts is generally used instead of 7200 volts.

The choice of 4160 volts or 13,200 volts may be one of economics, in which case there are two factors involved. If interrupting duty at 4160 volts can be kept below 50,000 kva., inexpensive switchgear may be employed and more than offset the extra cost of cable required for 4160 volts instead of 13,200 volts. On the other hand, if interrupting duties are higher than 50,000 kva.,

5-kv. switchgear becomes almost as expensive as 15-kv. gear. Hence, there is a saving in 13,200 volts because less cable is required to transmit a given amount of power.

In large plants of several thousand kva., 13,200 volts may be more economical because fewer circuits are required.

In many cases plant maintenance personnel may be able to handle 4160 volt cable installations but not 13,200 volt installations, hence economics is not the vital factor and the lower voltage may be selected.

Secondary Voltage

For motors used on machine tools in general manufacturing areas, 480 volts is most desirable because standard devices are available for this voltage, and because of the lower cost of the 480-volt distribution systems, compared with 208/120 or 240-volt distribution systems. The advent of fluorescent lighting has made it possible to place this load directly on circuits of the 480-volt class, particularly if those circuits are 4-wire grounded neutral.

There is always some load that must be supplied at 120 volts. This can be taken from the 480 system through step-down transformers at lower cost than by providing separate 120-volt unit substations (and feeders).

Loads consisting almost entirely of fractional-horsepower motors are best suited to 120-volt operation; 208/120 volt secondaries are therefore desirable.

To sum up:

1. Load-center distribution offers the advantages of shorter installation time, lower cost, and better performance of equipment than the older forms of distribution.

2. It conserves strategic materials for war uses since it enables more efficient utilization of material.

3. The most economical size of load center unit substation is 600 to 1000 kva. at 480-volt secondaries and 300 to 600 kva. at 208/120 volt secondaries.

4. Primary-supply systems for load-center distribution should be separated to reduce the possibility of complete shutdown by a single accident.

5. Primary voltage for the distribution plant should be either 4.16 kv. or 13.2 kv., as economics and maintenance standards dictate.

6. Secondary voltage in general should be 440-480 unless most of the load consists of fractional-horsepower motors.

7. Power and lighting can be taken off the same unit substation; fluorescent lights at higher voltage, and incandescent lamps through step-down transformers.



FIVE BUSHELS of white-hot metal particles daily shower from swing grinders towards the 3 driving motors. 2 are totally enclosed; 1 is open type. These particles were hot

enough to burn out open-type motor's insulation every 90 days, until management of this Pittsburgh steel plant had it rewound with Fiberglas 9 months ago. No burnouts to date.

Fiberglas helps steel plant in motor emergency

YOU COULDN'T FIND tougher working conditions for motors than a shower of burning metal particles and abrasive dust.

And you couldn't find a more dramatic example of the way Fiberglas electrical insulation withstands punishment than its performance in this Pittsburgh steel plant.

Strange as it seems, here is a case where Fiberglas insulation enabled an open-type motor to perform virtually as well under tough conditions as a totally enclosed job.

And while the ordinary practice would be to get a closed type motor, this emergency use of Fiberglas—

—has saved this steel plant a long wait for a new motor.

—has made it cheaper for the plant to rewind with Fiberglas than buy a new motor, and

—has worked so well that the plant no longer has expensive breakdowns and production tie-ups on these swing grinders.

But Fiberglas electrical insulation has other qualities, too, that make it valuable in other tough surroundings. Take the problem of corrosive vapor in chemical plants. Time after time Fiberglas-insulated equipment has demonstrated its superiority here, too. Why? Because this insulation is *not attacked by most acids*.

In addition, the individual glass fibers are inorganic and do not absorb moisture. Where a motor must perform in high humidity, as for example in a dry kiln or a coal mine, the Fiberglas-insulated motor comes through with flying colors, saves hours of downtime for repairs, and many dollars of maintenance expense.

If you are part of the "Arsenal of Democracy," you may still get new equipment, Fiberglas insulated, from your motor manufacturer. Otherwise, for added protection against downtime during the present emergency, rewinding your present equipment with Fiberglas may help you avoid costly delays. Ask your electrical service repair shop. *Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.*

*T. M. Reg. U. S. Pat. Off.

OWENS-CORNING

FIBERGLAS

EQUIPMENT News

Connector

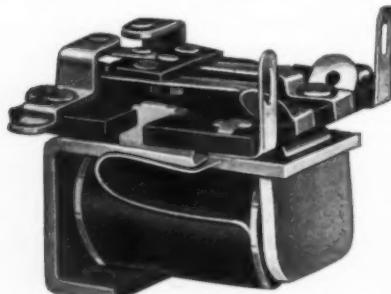
Type NVT is an all-clamp Type T-Connector for tapping cable from tubing. A flattened U-bolt on the tap accommodates a large range of cable sizes. In addition, the large compressive range of the U-bolt makes it suitable for clamping flexible and extra-flexible cables. On large conductor sizes, four oval-shank Everdur bolts are used to clamp the run conductor. For small sizes two bolts are used. Burndy Engineering Co., Inc., 459 East 133rd Street, New York, N. Y.



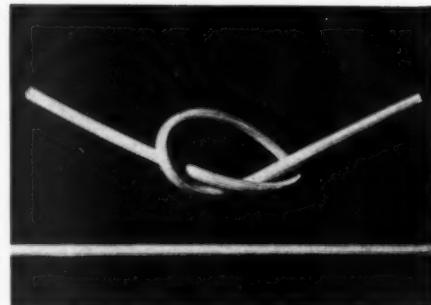
BURNDY CONNECTOR

Midget Relay

The new Series 195 d.c. midget relay is designed to provide maximum control in minimum space. Features are small size and light weight. Maximum contact capacity is approximately 150 watts, measured at 110 volt, 60 cycle, non-inductive a.c. Relay coil in this series is available for any voltage up to 75 volts d.c. Maximum contact combination available is double pole, double throw. A light armature operates the contacts, which are mounted on and insulated from the field piece, through a direct lever action. Coil and contact terminals are solder lug type. Guardian Electric Mfg. Co., 1642 West Walnut Street, Chicago, Ill.



GUARDIAN MIDGET RELAY



BRAND VARNISHED SLEEVING

Varnished Sleeving

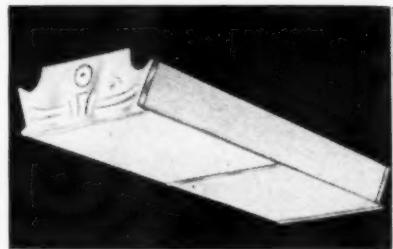
A new development in fibrous glass varnished sleeving has been announced, in which the glass braid is processed with a natural oil base varnish. It is claimed, that this process not only provides higher dielectric constants but obtains a greater degree of flexibility. The stretch factor is reduced to a minimum, insuring more stability and permanent values under various applications involving bending at more acute angles. A feature of Turbo glass sleeving is the elimination of circumferential wrinkles and gaps, it is claimed. It is available in two grades. William Brand & Company, 276 Fourth Avenue, New York, N. Y.



WIREMOLD INDUSTRIAL UNITS

Fluorescent Units

A new series of V-type two lamp industrial fluorescent units with porcelain enamel reflectors is available. They use basic Wiremold No. 3000 channel and fittings and provide flexibility in installation either as single or multiple two-lamp units making continuous runs of double Line-O-Lamps comprising any desired number of lamps. Available for 20 or 40 watt fluorescent lamps. Hangers and fittings are for installation against ceiling surfaces with canopies and adapters to cover existing ceiling outlets or for hanging at required levels below ceiling. The Wiremold Company, Hartford, Conn.



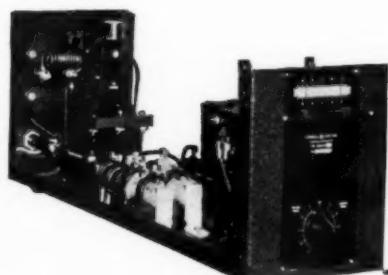
MITCHELL U.R.C. LUMINAIRE

Fluorescent Lighting

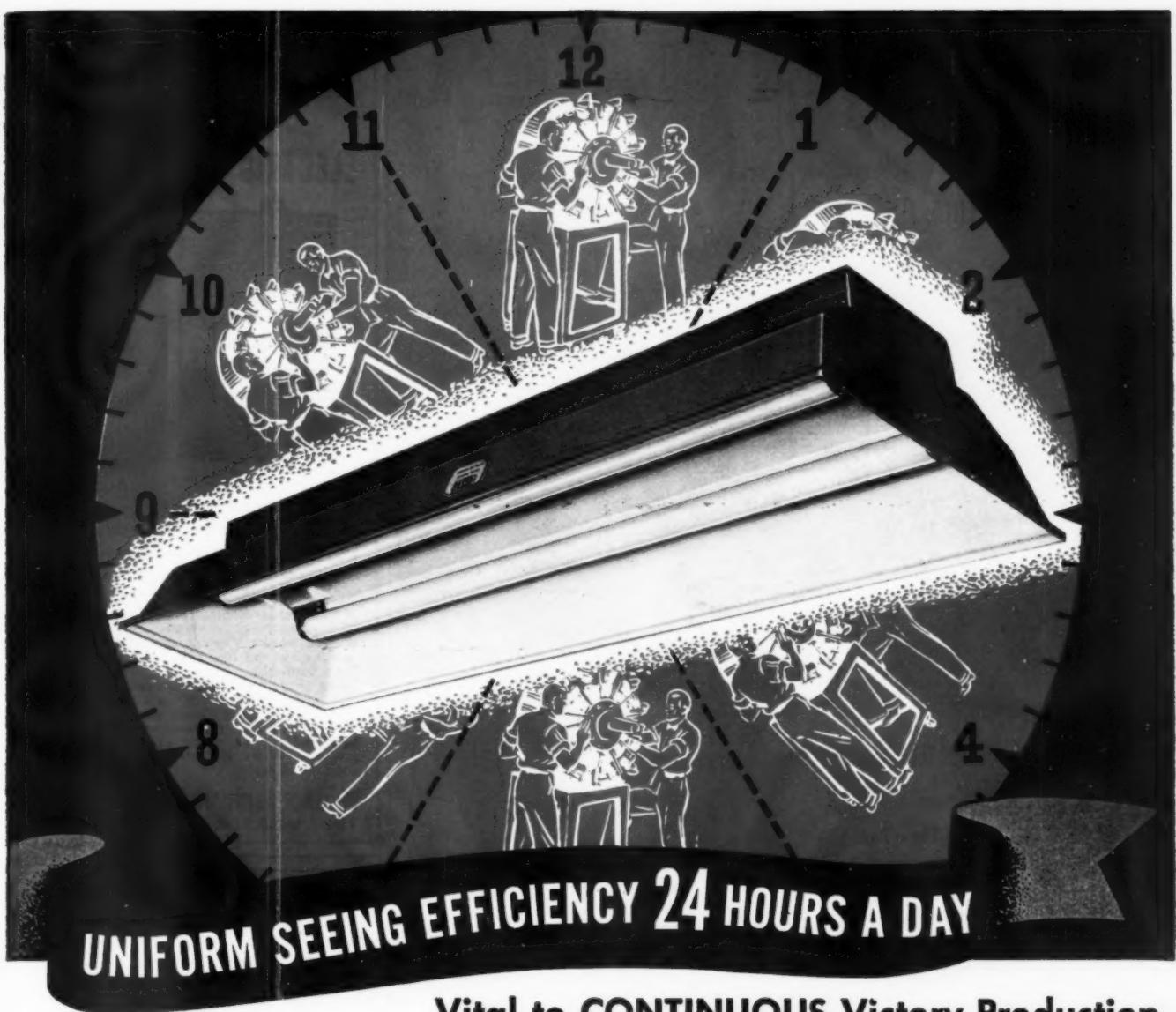
A new commercial fluorescent lighting fixture, known as U.R.C. "Research" luminaire, is available. This has been developed in accordance with the recommendations of the Utilities Research Commission. It is designed for mounting directly onto the surface of the ceiling, either as an individual unit or end-to-end for continuous rows. It can also be used for pendant hanging. It uses four 40-watt, T-12 fluorescent lamps. The side panels consist of double-strength ribbed ceramic-coated glass. Bottom panels are double-strength prismatic ribbed glass with transmission of not less than 85 per cent. Starter switches are of standard replaceable type. It operates on 110 to 125 volts, 60 cycle, alternating current. Also available for 50 cycle on special order. Dimensions are 48 $\frac{3}{4}$ -in. long; 19 $\frac{3}{4}$ -in. wide and 7-in. high. Mitchell Manufacturing Company, 2525 Clybourn Avenue, Chicago, Ill.

Instrument

A new peak-reading portable instrument, the magnetic oscilloscope, has been developed for use in resistance welding. It may be applied as a supplement to other instruments used in trouble-shooting and making installation adjustment. It is used in checking operation of electronic controls; adjustment of starting angle of control to correspond with power-factor angle of welding machines; adjustment of full-wave setting on control of phase-controlled welding machines to correspond with 100 per cent "heat" of control dial; and current measurements made with pointer-stop instruments. It is claimed to have a high-speed response to both current and voltage, made possible by use of permanent-magnet type of oscillograph galvanometer. It operates from 110-120 volt, 60 cycle current, using 25 watts. General Electric Co., Schenectady, N. Y.



G-E MAGNETIC OSCILLOSCOPE



UNIFORM SEEING EFFICIENCY 24 HOURS A DAY

Vital to CONTINUOUS Victory Production

● In aircraft factories, ordnance plants, shipyards, steel mills . . . wherever vital defense contracts call for fast, accurate, continuous output . . . adequate levels of light ranging from 25 to 75 foot-candles or more are required. By increasing the ease and speed of seeing, reducing eye-strain and fatigue, adequate light makes sustained effort and peak efficiency possible on all three shifts . . . and in every part of a plant.

Assurance that you will secure the maximum in lighting performance and economy from a lighting unit depends largely upon basic design and construction factors.

When you purchase Lighting Units bearing the RLM LABEL you know that exacting laboratory and engineering

tests have proved that they (1) Conserve light and power; (2) Stand up under the vibrations and heavy-duty service of producing machinery; (3) Require a minimum of time and cost to maintain at their original lighting efficiency; (4) Have uniform quality. Write for booklet, "The Meaning of the RLM LABEL."

Only Industrial Lighting Units built to exacting RLM Specifications, and certified by Electrical Testing Laboratories are permitted to carry the RLM LABEL.



Guarantee

This RLM certified lighting unit, when properly installed and under normal conditions of use, is guaranteed against mechanical and electrical defects for a period of 90 days from date of delivery to the purchaser. Correction of such defects by repair or replacement of material only shall constitute fulfillment of all obligations under this guarantee by the undersigned manufacturer or distributor.

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THE CERTIFICATE OF



UNIFORM QUALITY

**EVERY PHASE of
electrical maintenance
and repair work
covered in this library**



5 volumes of practical
how-to-do-it information

Every man concerned with the care and repair of electrical machinery should have these practical books, with their helpful tables, diagrams, data, methods and kinks. Every one of the five volumes is jammed to the covers with sound, how-to-do-it information—the kind you have to have when anything goes wrong. Liberal use has been made of practical data and practice in repair shops so as to combine the good features of a library of methods with handbook information covering these methods.

Electrical Maintenance and Repair Library

2042 pages, 1721 illustrations
and diagrams

These books show you how to

- install all types of motor and generator units;
- locate breaks in armature windings and do a workmanlike job of rewinding;
- know just what is wrong with an electrical machine and take charge of installation and maintenance work;
- make accurate tests of switchboards and apparatus and correctly balance the power with the load;
- handle every sort of wiring job;
- show competence whether it be in the use of a Stillson wrench or a Wheatstone bridge.

New trouble-shooting book

Now, in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's *Troubles of Electrical Equipment*, a new book full of helpful maintenance information, special trouble-shooting charts, explanation of symptoms and causes of machinery troubles, specific remedies, etc. This revised library gives you the ability to handle bigger jobs with surety of results.

10 days' examination Easy monthly payments

We want you to examine this Library for 10 days. If you don't want them at the end of that time, there's no obligation to keep them. On the other hand if you decide you want the help these books can give, start the small monthly payments then, and in a short time the books are yours, right while you have been using them. Send the coupon today.

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Send me Electrical Maintenance and Repair Library, 5 volumes, for 10 days' examination. If I find the books satisfactory, I will send you \$1.00 in 10 days, and \$2.00 a month until \$15.00 has been paid. Otherwise I will return the books postpaid.

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EQUIPMENT News

[FROM PAGE 112]

Drill

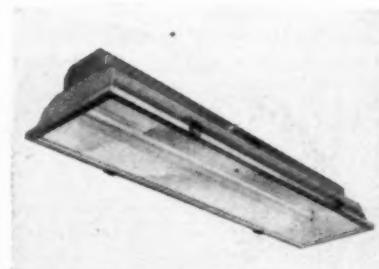
A new 1-inch drill, called skiddrill, has just been announced. It weighs 2½ lbs. and is 6½ in. long overall and 2½ inches wide. It is recommended for all production work in aircraft, tank, automobile, and other industrial fabrication. Also for drilling in maintenance work. Some of the features are die-cast body; anti-friction ball and needle roller bearings; helical-cut gearing; two-pole momentary contact switch with lock for continuous operation and Universal motor. It has no-load speed of 1800 r.p.m. and full-load speed of 1050 r.p.m. Drilling capacity in steel is 1 in. and in hardwood 1 in. Skillssaw, Inc., 5033 Elston Avenue, Chicago, Ill.



SKIDDRILL

Fluorescent Luminaires

This "high vision" fluorescent luminaire, known as type FPS-40, is for use in industrial plants. It uses 2 or 3, 40-watt fluorescent lamps per reflector and will provide lighting intensities of from 30 to 100 foot-candles. It is claimed to provide adequate visibility for close work such as reading precision micrometers, verniers and other shop instruments. Design of luminaire makes it possible to construct any length of strip desired from four types. Channels provide continuous wireway which may be mounted on conduit, messenger cable, twin-rod suspension or directly on ceiling. All auxiliary equipment is mounted in channel. Units have twin-ballasts with built-in compensators. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.



WESTINGHOUSE FLUORESCENT LUMINAIRE

BADGER

Synchronous

ELECTRIC TIME SWITCHES



CONTRACTORS LIKE THEM BECAUSE:
they are dependable and easy to install

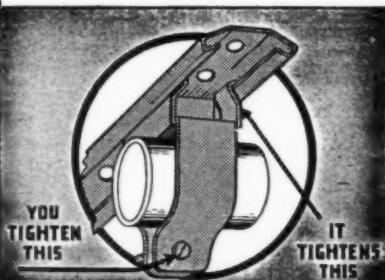
USERS LIKE THEM BECAUSE:
of economical operation and low cost

The Badger line of Time Switches is always in demand by Contractors who want dependability, accuracy, and the right type for a specific need. They know from experience that this is the line that gives them successful, profitable installations. They know when they install Badger Synchronous Electric Time Switches for their customers they are giving them complete satisfaction—accurate timing, economical operation, dependable service. You can't go wrong on Badger. Write for more particulars or see your Wholesaler.

RELIANCE AUTOMATIC LIGHTING COMPANY
1937 MEAD STREET RACINE, WISCONSIN

With Only One Screw
to Tighten . . .

THE CLEVELAND CONDUIT HANGER



Gives You a Quicker
Easier Installation

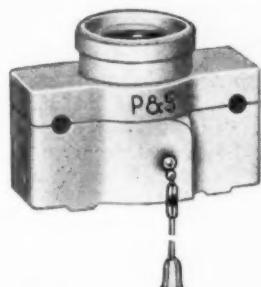
"CONVINCE YOURSELF"

"Send for Circular
Giving Full Details"

THE CLEVELAND SWITCHBOARD CO.
2927 E. 79 St. Cleveland, Ohio

Receptacles

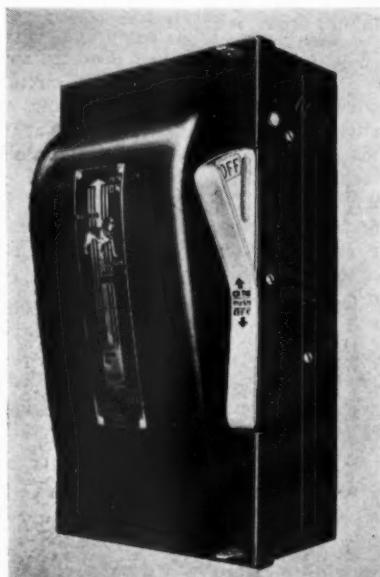
These new porcelain two-piece cleat receptacles with rectangular base and shade-holder groove are now available. They permit use of both surface and knob and tube wiring. Receptacles are specified for installation where knob and tube or open wiring is used. Ratings are keyless; 660 watts, 250 volts; pull; 250 watts, 250 volts. Dimensions for keyless are 3 $\frac{1}{4}$ by 1 $\frac{1}{2}$ by 1 $\frac{1}{2}$ in. overall height, screw spacing 1 $\frac{1}{8}$ in. Pull type measures 3 $\frac{1}{4}$ by 1 $\frac{1}{2}$ by 2 $\frac{1}{16}$ in. overall height, screw spacing 1 $\frac{1}{8}$ in. Pass & Seymour, Inc., Syracuse, N. Y.



PASS & SEYMOUR RECEPTACLES

Safety Switch

A new design of the Vacu-Break safety switch line has been developed. It has the Clampmatic switch contacts which secures and maintains perfect clamp pressure of switch contacts when in "on" position; yet a normal push of operating handle will "make" or "break" the circuit with automatic ease, it is claimed. Other features are simplified operating mechanism, formed Bakelite arcing chamber and front operated rocker handle. Switch is available in capacities from 30 amp. to 200 amp. incl. in both the Master Type "A" line and the Standard Type "C" line. BullDog Electric Products Co., 7610 Jos. Campau Avenue, Detroit, Mich.



BULLDOG SAFETY SWITCH

When you sell
QUAD
LIGHTING UNITS
BEARING THE
RLM LABEL
YOU SELL CUSTOMER
Satisfaction



• QUAD Units all have correct basic design and construction features. The RLM Label on QUAD Lighting Units assures your customers of modern, correct, and high quality commercial and industrial lighting. It's the line that will be popular tomorrow as well as today.



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RLM THREADED
DOME REFLECTOR

QUADRANGLE MFG. COMPANY

Mfrs. of Incandescent and Fluorescent Lighting Equipment
32 SO. PEORIA ST. CHICAGO, ILL.

Now—102 engineers and scientists help make the new

STANDARD HANDBOOK

for

ELECTRICAL ENGINEERS

dependable and practical for you

What the Standard gives you

- definitions, conversion factors, physical and mathematical principles.
- accepted formulas and experimental data.
- bases of design of electrical equipment for commercial performance.
- principles and practice of assembling such apparatus into systems.
- criteria and results in applying electricity in various industries, etc.
- the information you want in the form in which you can use it; the means of avoiding errors, saving time and trouble in procuring vital information, assuring yourself of best results in handling a wide variety of problems.

Thousands of useful facts in these
26 BIG SECTIONS

- Units and Conversion Factors
- Electric and Magnetic Circuits
- Measurements
- Properties of Materials
- Circuit Elements
- Transformers, Regulators and Reactors
- Alternating-current Generators and Motors
- Direct-current Generators and Motors
- Rectifiers and Converters
- Prime Movers
- Power Plant Economics
- Power System Electrical Equipment
- Power Transmission
- Power Distribution
- Wiring Design—Commercial and Industrial Buildings
- Illumination
- Industrial Power Applications
- Electric Heating and Welding
- Electricity in Transportation
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Benefit as thousands have

Tens of thousands of engineers have benefited from former editions of the Standard. With this up-to-date edition you will too. On hand when you need it, the book gives security in troublesome situations, saves dollars, hours, and effort by giving the right, dependable answer at the right time. Take this easy step that may mean much to you later. Mail the coupon today.

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Send me a new 7th edition Standard Handbook for Electrical Engineers for 10 days' examination on approval. Within 10 days of receipt, I will send you \$8.00, plus few cents postage, or return book postpaid. (We pay postage on orders accompanied by remittance.)

Name

Address

City and State

Position Company E.C. 1-42

(Books sent on approval in U. S. and Canada only.)

Capacitors

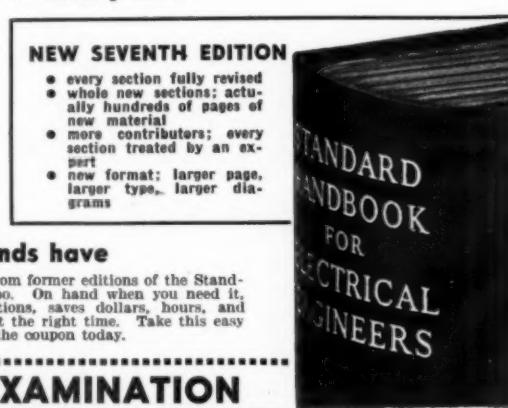
A new Series 72 oil-impregnated oil-filled capacitor with four-pin base that fits into standard UX sockets has been announced. The aluminum-sprayed tin-plate round can comes in 2-, 2½- and 3-in. diameter sizes and from 2½- to 4½-in. high. It is provided with a mounting ring with lugs. These oil-filled plug-ins are available in single-section units up to 16 mfd., and up to 4-4-4 mfd. in multiple-section units, in both 400 and 600 volt D.C.W. ratings. Capacitors are recommended for equipment used by Army, Navy, police, broadcast stations, and public address systems. Aerovox Corporation, New Bedford, Mass.



AEROVox CAPACITORS

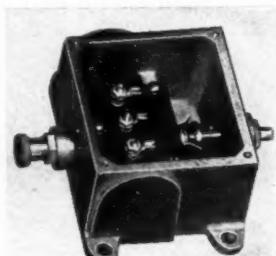
NEW SEVENTH EDITION

- every section fully revised
- whole new sections; actually hundreds of pages of new material
- more contributors; every section treated by an expert
- new format; larger page, larger type, larger diagrams



Marine Door Switch

A new combination door operated switch and manually controlled short circuiting device has been announced. It allows door switch to be made inoperative at will. This device removes necessity of installing a separate control in the circuit of each door switch. The unit is contained in a water-tight casting to permit installation on any type of door frame. Betts & Betts Corporation, 551 West 52d Street, New York, N. Y.



BETTS & BETTS DOOR SWITCH

Defense Savings Pay-Roll Allotment Plan

How company heads can
help their country, their
employees, and themselves

voluntary pay-roll allotment plan helps workers provide for the future helps build future buying power helps defend America today

This is no charity plea. It is a sound business proposition that vitally concerns the present and future welfare of your company, your employees, and yourself.

During the post-war period of readjustment, you may be faced with the unpleasant necessity of turning employees out into a confused and cheerless world. But you, as an employer, can do something now to help shape the destinies of your people. Scores of business heads have adopted the Voluntary Pay-roll Allotment Plan as a simple and easy way for every worker in the land to start a systematic and continuous Defense Bond savings program.

Many benefits . . . present and future. It is more than a sensible step toward reducing the ranks of the post-war needy. It will help spread financial participation in National Defense among all of America's wage earners.

The widespread use of this plan will materially retard inflation. It will "store" part of our pyramiding national income that would otherwise be spent as fast as it's earned, increasing the demand for our diminishing supply of consumer goods.

And don't overlook the immediate benefit . . . money for defense materials, quickly, continuously, willingly.

Let's do it the American way! America's talent for working out emergency problems, democratically, is being tested today. As always, we will work it out, without pressure or coercion . . . in that old American way; each businessman strengthening his own house; not waiting for his neighbor to do it. That custom has, throughout history, enabled America to get things done of its own free will.

In emergencies, America doesn't do things "hit-or-miss." We would get there eventually if we just left it to everybody's whim to buy Defense Bonds when they thought of it. But we're a nation of businessmen who understand that the way to get a thing done is to systematize the operation. That is why so many employers are getting back of this Voluntary Savings Plan.

Like most efficient systems, it is amazingly simple. All you have to do is offer your employees the convenience of having a fixed sum allotted, from each pay envelope, to the purchase of Defense Bonds. The employer holds these funds in a separate bank account, and delivers a Bond to the employee each time his allotments accumulate to a sufficient amount.

Each employee who chooses to start this savings plan decides for himself the denomination of the Bonds to be purchased and the amount to be allotted from his wages each pay day.

This space contributed by ELECTRICAL CONTRACTING

How big does a company have to be? From three employees on up. Size has nothing to do with it. It works equally well in stores, schools, publishing houses, factories, or banks. This whole idea of pay-roll allotment has been evolved by businessmen in cooperation with the Treasury Department. Each organization adopts its own simple, efficient application of the idea in accordance with the needs of its own set-up

No chore at all. The system is so simple that A. T. & T. uses exactly the same easy card system that is being used by hundreds of companies having fewer than 25 employees! It is simple enough to be handled by a check-mark on a card each pay day.

Plenty of help available. Although this is your plan when you put it into effect, the Treasury Department is ready and willing to give you all kinds of help. Local civilian committees in 48 States are set up to have experienced men work with you just as much as you want them to, and no more.

Truly, about all you have to do is to indicate your willingness to get your organization started. We will supply most of the necessary material, and no end of help.

The first step is to take a closer look. Sending in the coupon in no way obligates you to install the Plan. It will simply give you a chance to scrutinize the available material and see what other companies are already doing. It will bring you samples of literature explaining the benefits to employees and describing the various denominations of Defense Savings Bonds that can be purchased through the Plan.

Sending the coupon does nothing more than signify that you are anxious to do something to help keep your people off relief when defense production sloughs off; something to enable all wage earners to participate in financing Defense; something to provide tomorrow's buying power for your products; something to get money right now for guns and tanks and planes and ships.



FREE - NO OBLIGATION

Treasury Department, Section A,
709 Twelfth St. NW., Washington, D. C.

Please send me the free kit of material being used by companies that have installed the Voluntary Defense Savings Pay-Roll Allotment Plan.

Name _____

Position _____

Company _____

Address _____



RHEOSTATS FOR SEARCH LIGHTS

The search-lights of tonight that can locate flying death in the heavens are far different equipment from the much publicized lights that guided gun fire on Admiral Dewey's ships. Improvements in search-lights during the past fifty years have been comparable with improvements in all electrical equipment. It has been the privilege of the Ward Leonard organization to design and build most of the controls for

search-lights through the entire development period. It is not surprising, therefore, that this invaluable experience should be enlisted by our government.

WARD LEONARD

RELAYS • RESISTORS • RHEOSTATS

Electric control  devices since 1892.

WARD LEONARD ELECTRIC COMPANY, 28 SOUTH ST., MOUNT VERNON, N. Y.



VICT-A-FLEUR
INDUSTRIAL

• For Individual or Continuous line installation.
 • Patented "One Man Installation" device for easy hanging.
 • Wiring accessible without dismembering the fixture.
 • Provision for addition of a third lamp.
 • "Klasium White" reflecting surface . . . our permanent enamel finish.

UNDERWRITERS APPROVED
CERTIFIED FLEUR-O-LIER

LIGHTING PRODUCTS, INC.
HIGHLAND PARK ILLINOIS, U.S.A.

LUMINAIRE

WRITE FOR BULLETIN 275 AND "KLASIUM" FOLDER WITH SAMPLE

Meter

A new combination watthour and thermal demand meter is available in standard house size, case and mounting. It has a.c. ratings of 5, 15 and 50 ampere capacities, 120 to 240 volts, 2 and 3 wire for reading up to 20 kilowatts. The voltage component of thermal element is fed by secondary coil wound directly over potential coil of watthour meter. Dial and nameplate are combined with demand scale located at bottom of dial. Two demand pointers are provided; one operating as a pusher and the other to indicate maximum demand. Watthour mechanism has standard adjustments for full load, light load and power factor; the thermal unit has two adjustments for zero and full scale. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.



WESTINGHOUSE METER

Inter-Communicating System

This electric paging and inter-communicating system, called Convers-O-Call, is for use in offices, factories, restaurants, hotels, hospitals, and institutions. It allows conversation between one to ten people at one time or individually. Calls can originate from either end. A two way voice-link at any distance up to 15,840 feet. It replaces bells, buzzers—instant loud speaker communication. It operates on 110-125 volt alternating or direct current from a single outlet. It can also be used as a public address or paging system. Employees can answer 50 to 100 feet away from substation unit without leaving their work. National Inter-Communicating Systems, 2434 Montrose Avenue, Chicago, Ill.

Door Switch

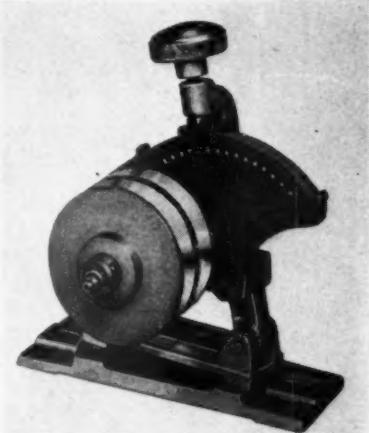
A new line of door switches both watertight and non-watertight, single and two pole, have been developed. They prevent direct or reflected white light to the weather when doors are opened. One of the features is a key operated mechanical locking device, which locks switch in closed position, eliminating short circuiting switch previously installed in circuit. The unit is cast brass, $3\frac{1}{4}$ by $1\frac{1}{4}$ by $1\frac{1}{4}$ in. deep. Burkaw Electric, Inc., 381 Fourth Avenue, New York, N. Y.



BURKAW DOOR SWITCH

Speed Transmission

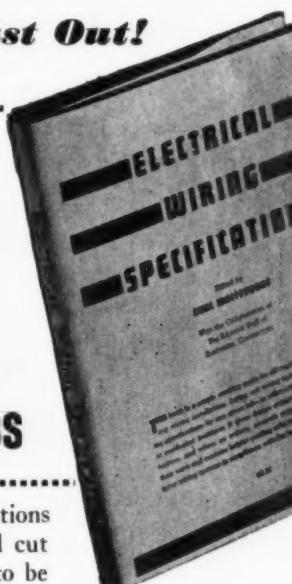
A new V belt variable speed transmission, known as JFS-CUB, has been developed. It is designed for all "A" section V belt applications and for speed ranges up to 3.3-in. Smooth sided pulleys are used rather than interlocking type. Some of the advantages claimed are: positive belt alignment feature; machined and balanced cast iron construction; free-end pulley spindle; both pulleys on one side of pivotal mechanism, which permits motor pulley and driven pulley to be directly in line with each other. Standard Transmission Equipment Company, 416 W. 8th Street, Los Angeles, Calif.



STANDARD VARIABLE SPEED CONTROL

Just Out!

Simplifies, speeds up, and improves the PLANNING AND SPECIFYING OF ELECTRICAL WIRING JOBS



Now you can make sure that plans and specifications tell all and tell it clearly—to help sell the job, and cut down losses from misunderstandings about what's to be done and how it's to be done. This new book gives a simple guiding system—tells in the most concise, direct manner what steps to follow, what

data to use—a valuable tool for designers, estimators and contractors.

ELECTRICAL WIRING SPECIFICATIONS

By EARL WHITEHORNE
and the Editorial Staff of
Electrical Contracting

181 pages, 6 x 9
48 illustrations, \$2.50

- Do you want to know just what sort of proposal is most effective for a small job?
- Do you want to make sure you get in everything that should go in a big job?
- Do you want to be sure of considering all pertinent rules and standards that affect a particular job?
- Do you want to know how to put installation parts, materials, costs, etc., in the form that eliminates misunderstandings?

This book gives you a step-by-step procedure for drawing up wiring plans and specifications that will do a better selling job and aid efficient construction. Covers wiring for light, power and signaling—in industrial, commercial, farm, and residential buildings—outlining a simple way of developing specifications, and giving guiding rules of the National Electrical Code, standards, engineering data, and diagrams to simplify your work.

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2. Residential Wiring
3. Apartment-house Wiring
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- Part II. **WIRING COMMERCIAL INSTITUTIONAL, AND FACTORY BUILDINGS**
5. Rules for Planning
6. What to Do for Lighting
7. What to Do for Power
8. Provision for Heating Load
9. Signaling and Communication
10. How to Specify the Large Job
11. Submitting the Proposal
Appendix. Code Tables

10 DAYS' FREE EXAMINATION

Mail this coupon

McGraw-Hill Book Co., Inc., 330 West 42nd Street, New York

Send me Whitehorne's Electrical Wiring Specifications for 10 days' examination on approval. In 10 days I will send \$2.50 plus few cents postage, or return book postpaid. (We pay postage on orders accompanied by remittance.)

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EC. 1-42

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HAVE WE OVERLOOKED YOU? Every effort has been made to place E.B.R. in the hands of the key men—the men who specify and requisition—in the larger Utilities, Industrials, Wholesaling and Contracting Companies, Government Defense Activities.

Notwithstanding the time, effort, skill and money put into building E.B.R.'s distribution list, we are not infallible. If you think your own company rates a copy, and isn't now getting it, we'll appreciate hearing from you about it on your company letterhead, with data on your operations and your name and title, please.

Get up-to-the-minute buying information you need today — more than ever before

Looking for new sources of supply? Here are over 3,500 of them!

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Want catalog information? In the new Electrical Buyers Reference you'll find condensed catalogs (Briefalogs) from outstanding manufacturers, covering a wide variety of electrical and allied products.

Turn to this 1942 edition first—it's the quickest, easiest way to get the answer to a lot of buying problems. It will pay to keep your copy within reach during 1942!

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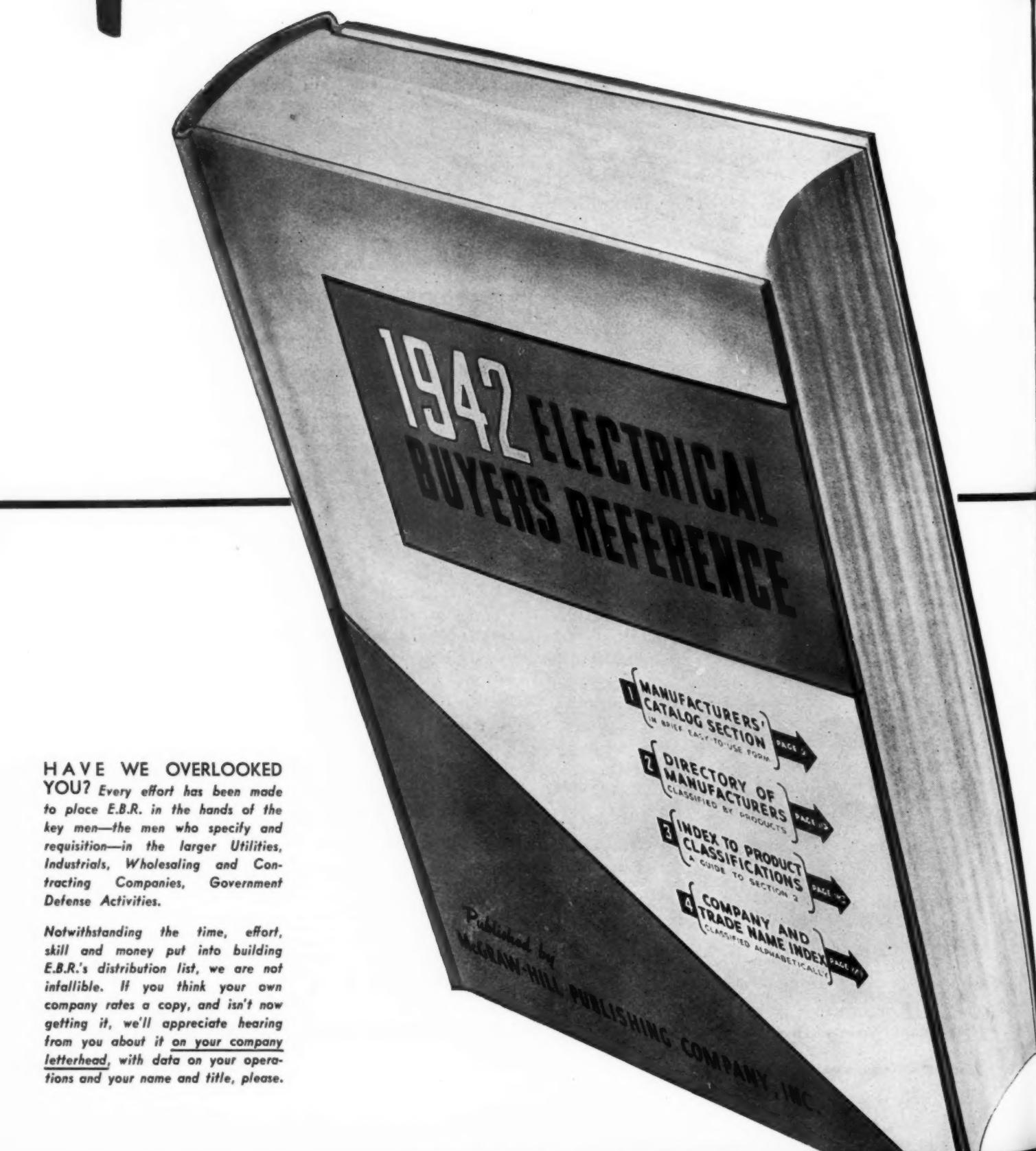
1. **Manufacturers' catalogs**—A series of catalogs, usually in condensed form ("Briefalogs," we call them). These vary in size—depending upon the needs of each manufacturer.
2. **Directory of Manufacturers**—With company names, addresses, and trade names, arranged by product. Extensive cross-references permit quick finding of the electrical and allied products made by over 3,500 manufacturers. Bold-face listings throughout indicate the pages upon which the product data (Briefalogs) of manufacturers is given.
3. **Index to Directory Classification**—A complete alphabetical list of all classifications covered in the Classified Directory Section, cross-indexed from every commonly used name, including adjective references. Facilitates finding of products, regardless of how reference is made.
4. **Index of Trade and Company Names**—Complete with addresses. A buyer starting out with only a trade name quickly gets the buying data he needs.

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4. **Index of Trade and Company Names**—Complete with addresses. A buyer starting out with only a trade name quickly gets the buying data he needs.

INDUSTRY ON THE MARCH

for



SUPREMACY IN 1942

"Happy New Year" for '42 must be more than good-will wishes. To the end that we all enjoy a year of happiness, it becomes a duty to produce still better products—still faster deliveries. "All That the Name Implies" in

SUPERIOR MOTOR BRUSHES
SUPERIOR
CARBON PRODUCTS INC.
9115 George Ave., Cleveland, Ohio

Balanced



Qualifications

MULTI FLUORESCENT REFLECTORS

- Thoroughly modern
- Types for general or local lighting
- High lighting efficiency
- Low first cost
- Easy to install
- Economical to service

Send for complete catalog

MULTI
ELECTRICAL
MANUFACTURING CO.
1840 W. 14TH ST. CHICAGO, ILL.

EQUIPMENT News

[FROM PAGE 119]

Rectifiers

A complete line of full-wave industrial rectifiers, ranging from 100 to 15,000 watt capacity, has been developed. They are designed for use in operation of magnetic chucks, variable speed d.c. motors, telephone switchboards, service station battery chargers, electroplating installations, circuit breaker reclosing mechanisms, industrial truck and railway car battery chargers. Two single plate tubes, one for each half cycle, are used in units. They are housed in enclosed cabinets designed for wall mounting. A terminal strip is provided for connecting a.c. input and d.c. output lines. Weltronic Corp., E. Outer Drive, Detroit.

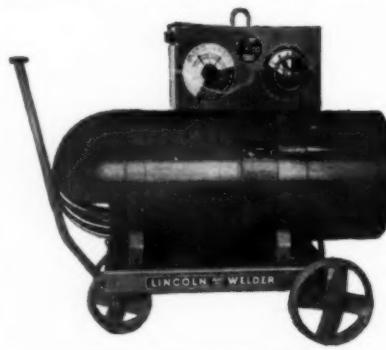


WELTRONIC INDUSTRIAL RECTIFIER



Arc Welder Control

An improved and simplified design of the system of dual continuous control for arc welding machines has been announced. These welders have both job selector and current control calibrated and equipped with dials which indicate type of work and number of amperes for each setting. It is claimed that this feature enables operator to secure high quality welds and high speeds because he can vary both slope of volt-ampere curve and amount of welding current independently to suit every job. Both voltage control and current control are continuous in operation. Control can be advanced or retarded in increments as fine as desired. Other features are ability to set and read current from dial; availability of positive polarity reversal and ability to verify polarity by noting position of switch handle. Lincoln Electric Co., 12818 Coit Road, Cleveland.



LINCOLN ARC WELDER CONTROL

SEARCHLIGHT SECTION

(Classified Advertising)

Employment Business

Equipment

(Used or Resale)

"OPPORTUNITIES"

UNDISPLAYED RATE

15 Cents a Word. Minimum Charge \$3.00. POSITIONS WANTED (full or part time salaried employment only), $\frac{1}{2}$ the above rates payable in advance. BOX NUMBERS—Care of publication New York, Chicago or San Francisco offices count as 10 words. DISCOUNT OF 10% if full payment is made in advance for 4 consecutive insertions.

DISPLAYED RATE

INDIVIDUAL SPACES with border rules for prominent display of advertisements. The advertising rate is \$8.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request. AN ADVERTISING INCH is measured $\frac{1}{2}$ " vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS received by January 20th will appear in the February issue, subject to limitations of space available.

SELLING OPPORTUNITY WANTED

WANTED TO REPRESENT a manufacturer for the State of Florida have 25 years experience in the Electrical Supply line reside in Florida. RA-29. Electrical Contracting, 330 W. 42nd St., New York, N. Y.

Your Pacific Coast Branch

If you are considering closing your Pacific Coast Branch on account of present conditions, a sales organization, with warehouses, would like to hear from you, as they may be in a position to be of service.

RA 28 Electrical Contracting,
68 Post St., San Francisco California

USED EQUIPMENT

FOR SALE

ANOTHER OPPORTUNITY FOR ELECTRICAL DEALERS

You can buy from Moreco and Resell at competitive prices and still make plenty profit. Send us your inquiries. We co-operate with dealers.

75 KW Gen. Elec. 125 volt D.C. 8 bearing M.G. Set driven by a 2200 volt, 3 phase, 60 cycle, 1200 RPM motor.

35 KW Westinghouse, M.G. Set 125 volt D. C. generator driven by 54 H.P. 220/440 volt 3 phase, 60 cycle, 1200 RPM CS motor.

300 amp. 40/60 volt Lincoln Welder with 10 H.P. 220 volt, D.C. motor.

THE MOTOR REPAIR & MFG. CO.
1560 Hamilton Ave. Cleveland, Ohio

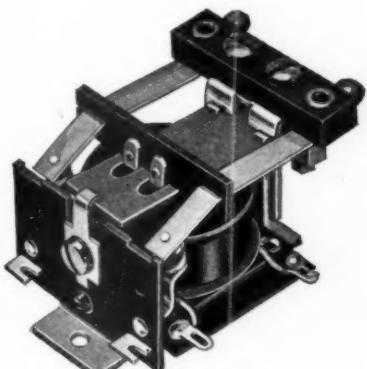
WE BUY AND SELL

MOTORS
TRANSFORMERS
MOTOR GEN. SETS
OIL SWITCHES
AIR CIRCUIT BREAKERS

ELECTRIC EQUIPMENT CO.
347 W. Clinton Ave., Rochester, N.Y. Tel. Main 252

Relay

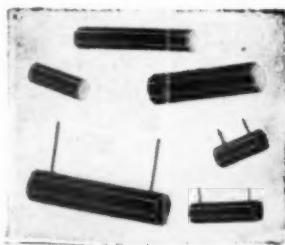
Series 165 vibration resistant relay is designed for applications such as aircraft, generator mountings, etc. It is claimed that the relay, with two normally open contacts, would withstand a vibration test of 16.2 times gravity without making contact when the coil was de-energized or breaking contact with the coil energized. Relays are insulated from ground with insulation withstanding a minimum of 1500 volts. Contact combinations up to double pole, double throw are available, with contact capacity up to 12.5 amperes per pole, measured at 110 volt, 60 cycle, non-inductive a.c. Overall dimensions are 2 $\frac{1}{2}$ by 1 $\frac{1}{2}$ by 1 $\frac{1}{2}$ in. Rating is 24 volts d.c. Guardian Electric Mfg. Co., 1642 West Walnut St., Chicago, Ill.



GUARDIAN RELAY

Resistors

A new line of negative temperature coefficient resistors is now available, with metal coated ends for making electrical connection. It is claimed that the chief characteristic of these resistors is their decrease in electrical resistance with an increase in temperature. This property makes the material useful where it is desired to reduce or eliminate initial current surges, to secure a time delay or "gradual building-up" of the current through a piece of equipment, to provide temperature compensation in apparatus or equipment which exhibit rising resistance with increase in temperature, and for other applications where a negative temperature coefficient is required. They are available in four sizes— $\frac{1}{2}$ - by $\frac{1}{2}$ -in.; $\frac{1}{2}$ - by $\frac{1}{4}$ -in.; $\frac{1}{2}$ - by 1-in. and $\frac{1}{4}$ - by 1-in. These have maximum wattage ratings ranging from 0.75 to 3.0 watts. Keystone Carbon Company, 1935 State St., Saint Marys, Pa.



KEYSTONE RESISTORS

WHERE TO BUY

Equipment, Materials and Supplies for Electrical Construction—Maintenance—Repairs

LOW VOLTAGE TATTELITE



Range 3 to 25 volts. Tests automotive currents on aeroplanes, autos, trucks, etc.; telephones, temperature controls, doorbell circuits, radio, continuity tests where low voltage is used. Pocket size, sturdy. Price \$1.75 each.

NEON TATTELITE

Indicated voltages from 90 D.C. and 60 volts A.C. to 500 A.C. & D.C. Tests for live lines, polarity, blown fuses, grounded lines, etc. Will not "blow" like ordinary test lamp. Has "phone tip" prods. Price \$1.00 each. Write for Littlefuse catalog.

LITTELFUSE, INC.
4789 N. Ravenswood Ave. Chicago, Ill.

Electric Operators
For Any Overhead Type Door
DOORS AND OPERATORS INC.
See page 295
Elec. Buys. Ref. TIFFIN, OHIO

TEST-O-LITE

Tests Everything Electrical
From 100 to 550 Volts

Indispensable to electricians. Equipped with Neon light which tells instantly where trouble lies in electric circuits, fuses, cut-outs, motors, radios, electric appliances; indicates hot or grounded wires; tells A.C. from D.C.

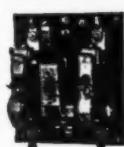


Only TEST-O-LITE, original Neon tester, has exclusive patented safety features. Far superior to clumsy test bulb. Fountain pen size with pocket clip. Useful in homes also.

List \$1.50
at leading jobbers.

L. S. BRACH
MANUFACTURING CORPORATION
57 Dickerson St., Newark, N. J.

ZENITH Quick MAGNETIC CONTACTORS



Electrically Held—Mechanically Held for all types of installations. Copper to copper contacts with rolling and sliding action. 30 to 600 amps., A.C. and D.C., 1 to 4 poles.

CATALOG. Save money with Zenith Automatic Control Equipment. Catalog free.
ZENITH ELECTRIC CO.
845 S. Wabash Avenue Chicago, Ill.

Your inquiry
will have special value . . .

If you mention this magazine, when writing advertisers. Naturally, the publisher will appreciate it . . . but more important, it will identify you as one of the men the advertiser wants to reach with his message.

DRILLS CONCRETE—METAL—WOOD



WODACK "DO-ALL"
ELECTRIC HAMMER AND DRILL
Saves time and money installing expansion anchors. Drills concrete to 1 $\frac{1}{2}$ " dia.; metal to $\frac{1}{2}$ ". Two tools in one. Easy to maintain. Universal motor. Write for folder.

Wodack Electric Tool Corporation
4628 W. Huron St. Chicago, Ill.
Telephone AUstin 9866



ALLEN NEUTRAL ROSIN FLUID FLUX

Absolutely safe for fine wires and all work. No corrosion hazard. Moisture free. Send for free samples.
L. B. ALLEN CO. INC. 6715 Bryn Mawr Av. Chicago, Illinois

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The SEARCHLIGHT (CLASSIFIED ADVERTISING) SECTIONS

of
Departmental Staff

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330 W. 42nd St., New York City

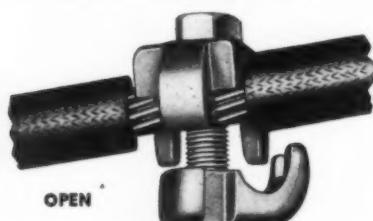
American Machinist
Aviation
Bus Transportation
Business Week
Chemical & Metallurgical
Engineering
Coal Age
Construction Methods
Electrical Contracting
Electrical Merchandising
Electrical World

Electronics
Engineering News-Record
Engineering and Mining
Journal
E & M J Markets
Factory Management
& Maintenance
Food Industries
Power
Product Engineering
Textile World
Transit Journal



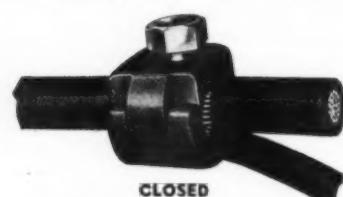
SWIVEL CLAMP CONNECTOR

No Removable Parts



OPEN

Catalog Nos. C6 to C10



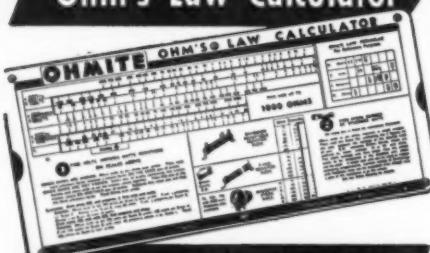
CLOSED

WRITE FOR CATALOG NO. 3LC

Showing Complete Line of
Solderless Lugs and Connectors

KRUEGER & HUDEPOHL
236 VINE ST. • CINCINNATI, OHIO

Everyone Can Use
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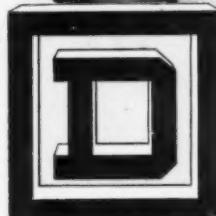
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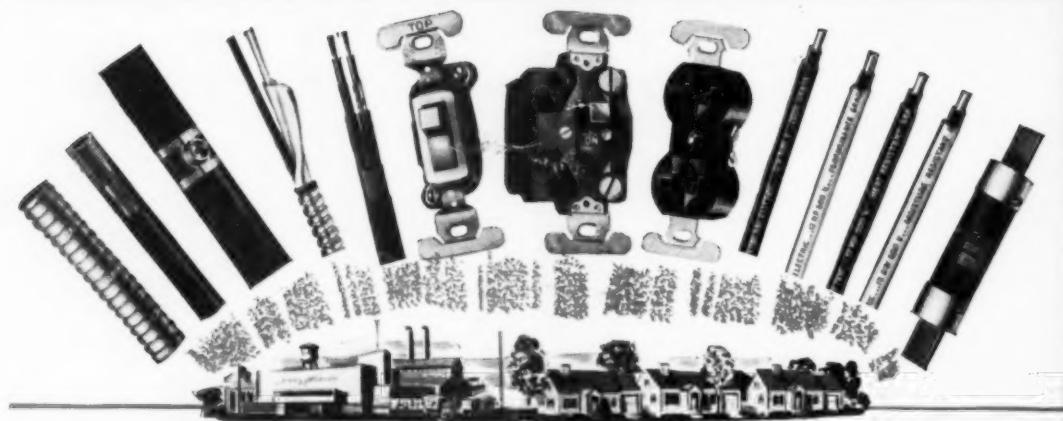
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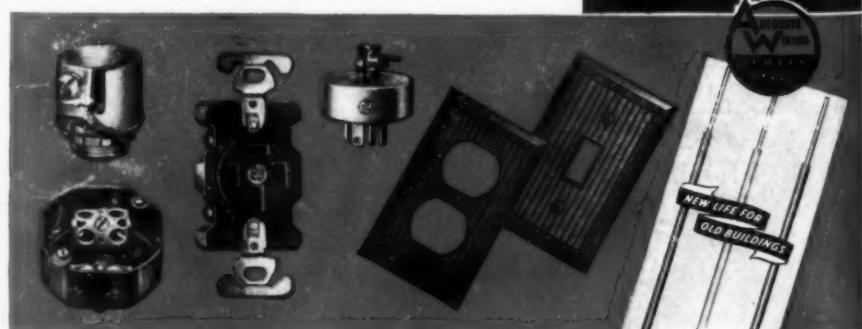
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